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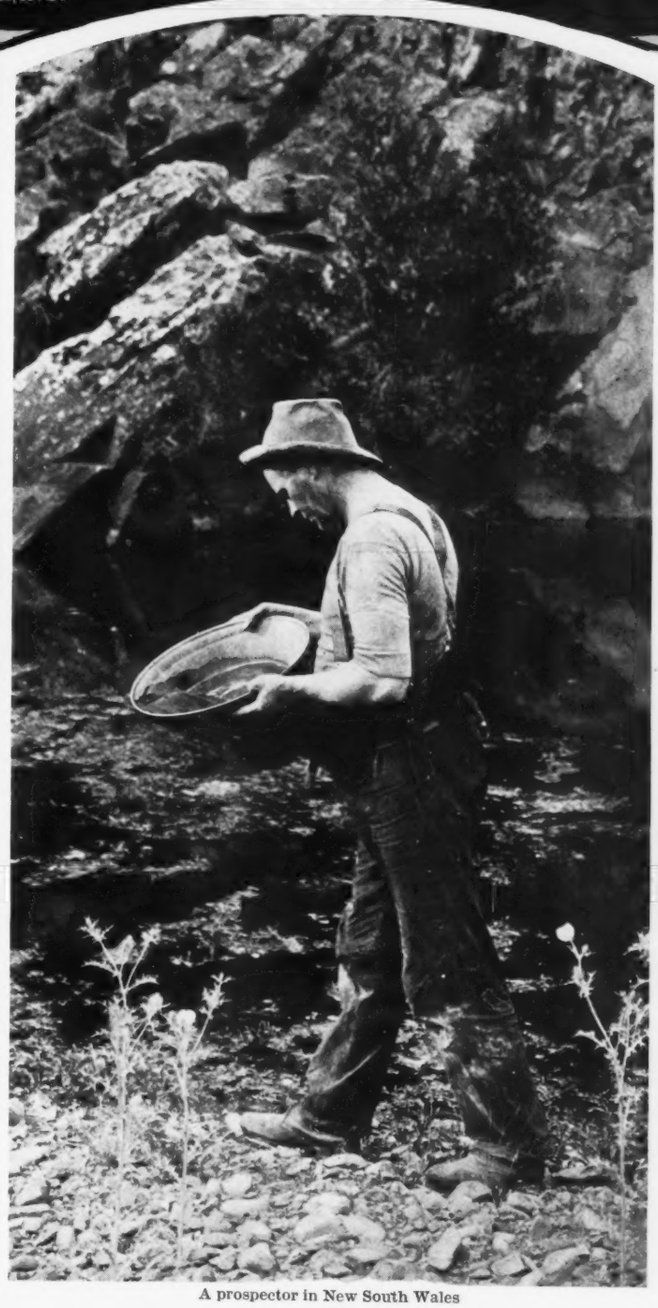

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October 7, 1922

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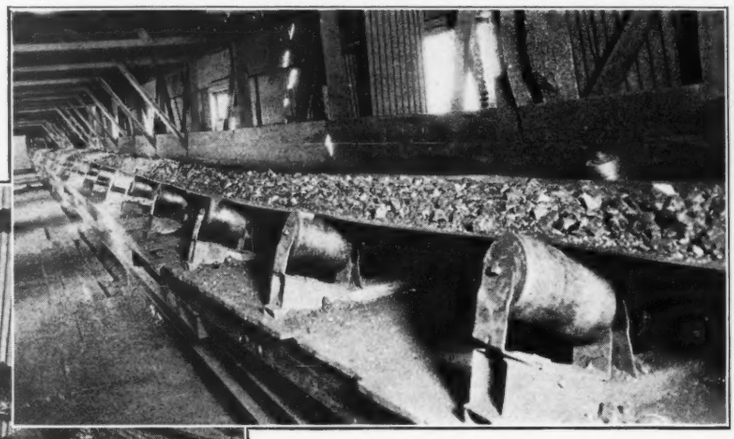

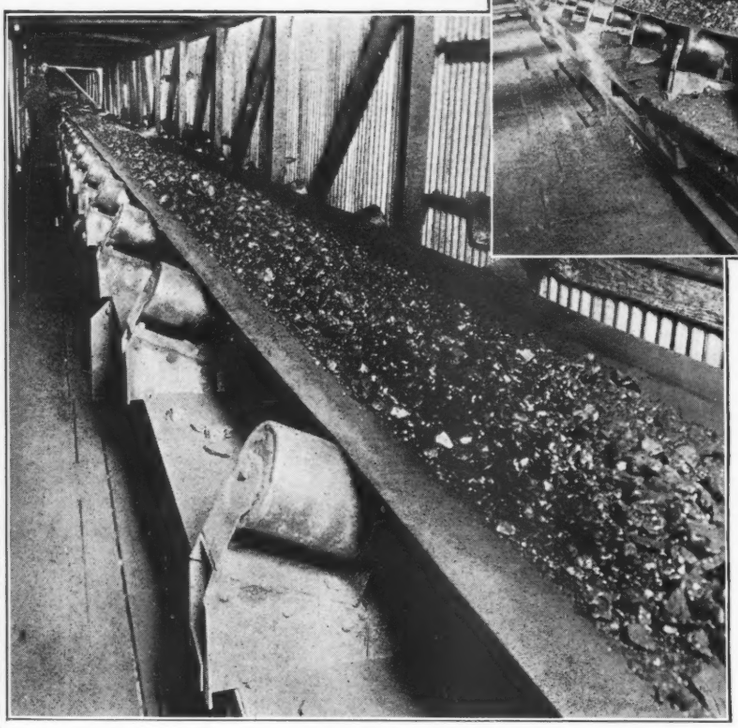

S-A Unit Carriers in tipple of Zeigler No. 1 Mine of Bell & Zoller Mining Co., Zeigler, Ill.

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Discriminating Among Mining Geologists

MINING GEOLOGY is a profession practiced under as many theories and with as wide a range of method, intelligence, and skill as the profession of medicine. When your system puzzles you, when you must seek the wise diagnostician of hidden bodily ailments, you choose, according to your lights, experience, or chance, between the homeopath, the osteopath, the surgeon, the patent-medicine booster, and the Christian Scientist. And then may Providence be with you! And when you cannot understand the hidden structure of your ore deposits, when your mine looks sick and shows disquieting signs of "passing out," you hie to a geologist as a last resort. If you are the kind of person to whom a doctor is a doctor, then you are the kind of person to whom a geologist is a geologist; and your pathway in either case is apt to be devious and beset with thorns and darkness.

All the learned professions have a trick of resorting to windy phrases to impress the uninitiate, a trick employed by those who otherwise would have no tricks to uncover; and mining geology is not dissimilar to medicine or the law in this recourse of the incompetent. They will fool the capitalist, but not the mine foreman, who is from Missouri where geologists are concerned, and wants to be shown, not lectured. To this prince of critics the development of a lost orebody which his own skill had failed to find is worth a barrel of enlightenment as to the difference between rhyolite and andesite; and he will follow anyone who can do this, whether he hail from Harvard or the school of practical experience.

The fact is, indeed, that the advance of the science has run ahead of its general practical application. Probably an exception should be made to this statement for petroleum geology, which is systematically pursued, enthusiastically discussed, and scientifically applied by a very considerable number of highly competent geologists, out of hundreds that are not competent. But petroleum geology is largely a matter of stratigraphy and structure, and is not so complex and difficult to apply properly as the geology of the metallic ores in general. The last-named subdivision of the science deals not only with stratigraphy and broad structural features but with the mystery and variety of the igneous rocks and their alterations, with innumerable forms of orebodies, with the widest range of concentration, from solid metal to great faint disseminations that grade off into unworkable material—hence from "ore" to "rock" (so much so, that in the Lake Superior copper region the two terms are confounded); and finally with a complex origin, the proper understanding of which is quite necessary to a clear diagnosis of what the mine under study can be developed into, and what its limitations are. No physician to sick mines can put ore into the ground if it isn't there any more than a doctor of medicine can prolong the span of human life past a certain point; but each can find out and utilize every possible resource, and work with a close understanding of nature and in harmony with that understanding. And for the mine specialist, who deals with inorganic nature, the problem is intrinsically easier than that of the tinker of the human body, who deals with inorganic chemistry and the unsolved psychological factor; and geological science has now actually developed so that this patent natural advantage can be availed of in mining.

If you are a mine owner or mine operator, and are not getting this type of geological service, it is incumbent on you to do what you would in case of unsatisfactory treatment of your liver or stomach—change your geologist for a better one, or at least check up by consulting a specialist, or even comparing one specialist against another, till in your own judgment you have the best opinion that the state of the science admits. If you have a good mine it will pay you to go to all this trouble and expense to save and prolong its life; if you are sure your prospect is only a stray cat, not far removed in breed from a wildcat, you can let anybody prescribe for it—and then use your own judgment.

Phthisis on the Rand

AMONG the many things that have been done well on the Rand have been the efforts to lessen the ravages of phthisis among the miners in the gold mines, and the system whereby the victims of the disease or their families are compensated. In 1919 a compensation fund was established, and under it a liability estimated at £3,000,000 was created, besides starting three farm settlements for those afflicted with phthisis, which in the South African mines takes the form of silicosis, which may be described as the injury done to the tissue of the lungs by the siliceous dust made in breaking ore and rock in the mines and mills.

For the first two years after the passage of the Compensation Act the mining companies contributed £200,000 quarterly, but after Aug. 1, 1921, the amount was decreased to £150,000 per quarter, only to be raised again forthwith to £200,000—that is, £800,000 per annum. It is estimated now that owing to the increasing proportion of those afflicted as compared with those dropping out of the list of beneficiaries, and the number of those passing from the primary to the secondary stage of the disease, the mining companies face a liability capitalized at £14,000,000. If one mine cannot pay its levy, it is distributed among the other mines. The miners used to pay 2½ per cent of their earnings to the fund, but that has ceased. In future the liability of each mine will be assessed each year, and the company owning the mine will be debited with the amount.

In 1913 the ravages of phthisis on the Rand were the subject of earnest discussion because it became known then that not only the miners but the managers and engineers had been ruined in health by the disease. The report of the Miners' Phthisis Board for the half-year

ending Jan. 31, 1913, made this distressful statement: "A miner with nine and one-half years' underground service, whose expectation of life under normal circumstances should be twenty-six years, has one and one-half years to live; with four and one-half years underground, normal life expectation twenty-seven years, has three and one-eighth years to live; with three years underground, normal expectation thirty-one years, has three and one-half years to live." This appalling decrease in the underground miner's expectation of life was a shock to the mining community and stimulated an earnest effort to use such methods of drilling, with water sprays, as would diminish the quantity of dust in the mines. Those efforts were successful in large part, but they did not suffice to eradicate the evil, as is now evident.

The disease, of course, exists among miners in this country, in places where drilling is done in siliceous rock yielding minute and sharp particles of quartz, but fortunately it is rarely that any one of our mines presents conditions identical with those obtaining on the Rand, where the ore is a conglomerate of quartzose pebbles between sandstone walls.

A North Carolina "Gold" Mine

ONE OF THE OLDEST gold-mining states in the Union is North Carolina; and for a long time numerous producers shipped bullion regularly to the U. S. Assay office at Charlotte. Of late years, however, few of the many attempts at mining gold have been successful, although the precious metal is scattered over the entire Piedmont section of the state. It is possible to pan a few colors from a large proportion of the small streams or "branches" in this region. Some years ago a number of large exploration companies sent engineers into North Carolina with the hope of finding an area which was of sufficient size, and in which the gold content was sufficiently high, to warrant a large placer enterprise to be worked by dredging or by hydraulicking. Although they found plenty of gold, they did not find enough of it in any one place to justify the attempt to exploit it.

But this is not to say that there are no successful "gold" mines in North Carolina today. We have in mind a group of placer mines which are not only in steady operation, but which are netting their owners a tidy profit every day and every month. Local gossip has it that the principal owner, C. J. Harris, has made several million in the last few years; even discounting the exuberance of public imagination, it is safe to say that Mr. Harris has made a lot of money. One of the mines, which is typical of all of them, is at Spruce Pine, a "one up one down local train a day" station on the C. C. & O. railroad, noted principally for its feldspar and mica mines. The Harris placer mine is in a large mass of remarkably clean white decomposed granite from 60 to 125 ft. thick, covered by an overburden of from 6 to 15 ft. of soil. Two yawning pits, covering perhaps six acres, have already been excavated, but auger drilling has proved the deposit to be adequate for many years' operations on the present scale.

Actual mining is done by a force of two men, working with a high-pressure hose line. When necessary they sluice to the boot of a belt-and-bucket elevator by means of which the ore is lifted high enough to run to the treatment plant by gravity. Formerly the material from the bottom of the pit was shoveled dry into buckets, hoisted, and then sluiced. The substitution of the bucket elevator made it possible to do all the mining by hydraulic methods and made a big cut in the cost of production. A large part of the upper part of the bed can of course be washed directly into the sluiceway. This launder leads to the treatment plant—a simple affair that almost runs itself. A sand wheel with bent sheet-iron blades takes out most of the coarse sand, and the remainder settles in a series of long, gently sloping launders. The rather monotonous but leisurely task of shoveling the settled sand out of these launders falls to a couple of typical North Carolineans, who seem not to fret because their job is not fraught with excitement. Next, the mica is removed from the pulp by means of 100-mesh copper screens which catch the flaky particles. A woman "dresses" the screens in succession by means of a short piece of rubber belt attached to a handle to form a hoe. After the mica, a profitable byproduct, is removed, the screened material flows to a settling tank, where part of the clear water is removed by decantation; the sludge is filtered in leaf presses; the cake is dried in shallow bins fitted with steam coils, and the resulting china clay, a beautiful white, is shipped to the pottery plants at $18 per ton or thereabouts.

The reader has doubtless perceived ere this the reason for the quotation marks around "gold." It was by way of apology for a bit of harmless chicanery, for kaolin or china clay is the real object of the enterprise. The mine, however, is a placer, and we venture to say that it has put more gold into the pockets of its owners than any gold mine whose record adorns the pages of North Carolina's mining history.

They are learning down South that there is good profit in exploiting the deposits of non-metallic minerals of divers kinds that are found almost everywhere. They are prospecting for new deposits; they are developing them more systematically; and they are adopting—even if slowly—more efficient methods of mining and milling. Gold mining is exceedingly romantic even in North Carolina, but many other kinds of mining are a great deal more certain and in the end far more profitable.

Tolerance and the Turk

MINING MEN are constantly looking hopefully to the Near East as a possible field for enterprise, whether for oil or metals. Recent events have put the Turk suddenly and firmly in mastery in Asia Minor, and made Turkey from an outcast nation to a power. What sort of people are these Turks? The common or bromidic answer is obvious—effete, cruel—the Terrible Turk, the Unspeakable Turk. Certain words in our vocabularies are all but reserved for the Turks, as *massacres, atrocities.* (True, we did hear of German atrocities during the war, but the Turk has the prior right.) Also, *fanatic, zealot.* The Greek army which attacked the Turks in Asia Minor was "patriotic." The Turkish army which drove them back was, according to our newspapers, "fanatical," inspired by "zealotry."

The Turks have the same fanatical desire to get back to Constantinople that the Frenchman would have to get back to Paris if driven from there by the English; the same zealotry that the English would have to get back to London if the Germans had driven them to the highlands of Scotland, or the Americans if driven out of Washington into the Appalachians and beyond. Constantinople has been the Turkish capital since 1453.

Recently it was remarked in conversation by one who

knew the situation somewhat that the other motley races of the Near East had their drawbacks as well as the Turk. "Do the other races kill people because of difference of religion?" was the challenging reply. It is true that we have had one continuous story of Armenian massacres. If each Armenian of the little nation had ninety lives, the reports tabulated would show that the sum was insufficient to account for the toll of massacres; and still there are living Armenians, very much in evidence. And the common or bromidic statement is that the Armenians have been thus repeatedly exterminated because they had a different religious belief.

Consider a little. In Constantinople, for example, there has always been a very large Christian percentage of the population—Greeks, Armenians, and the like; and a large Jewish population. The same was true of all cities of the old Turkish Empire. Since 1453, when the Turks took Constantinople, what a vast deal of leisure have they had to exterminate systematically! Yet in the reign of Abdul Hamid, called by Gladstone "Abdul the Damned," during one typical year of which we have personal knowledge, two members of the Sultan's Cabinet were Christians—one Greek and one Armenian; and the Turkish Ambassador to England was a Christian—a Greek. This only for example, not statistically stated. The fact is that the Turkish conqueror of Constantinople granted immediately to the conquered Greek Christians religious freedom and protection, and those promises have been maintained for five hundred years. During those five hundred years the religious intolerance and cruelty of one Christian against another—especially of Protestant against Catholic and the reverse, since the Reformation—is almost too horrible to read—in Spain, in England, and in France. An impartial judge will pronounce the record of Turkey for religious tolerance for that five hundred years perhaps the highest in Europe; not at all good, of course, but probably relatively the least bad.

The Jews differ in religion from the Turks more than do the Christians. Why have they not been "massacred" by the "fanatical Moslems"? The Christian nations—Russia recently, a little further back Rumania, and so on—deemed massacre a philosophical and religious argument; but the records concerning Turkey are silent on that point. The fact is that at many periods Jews have sought refuge in Turkey when persecuted by the Christian countries of Europe. In Spain, for example, the Jews flourished under Mohammedan rule, from the eighth century to the latter part of the fifteenth; but the Christian conquerors of Spain drove out the Jews, largely to seek refuge in Turkey, where their descendants still speak a Spanish patois. As the Encyclopedia Britannica remarks, "The medieval Jews, on the whole, lived under the Crescent a fuller and freer life than was possible to them under the Cross." And even in the reign of Abdul Hamid, when the Jews were being persecuted in Rumania, that much-execrated monarch welcomed Jewish refugees from Rumania, and gave them land to till and temporary remission of taxes.

The latest Turkish atrocity is Smyrna. The stories and statistics which have come out of the burning of Smyrna are sufficiently blood-curdling; but they bear evidence of being wild tales. An American, the special representative of the Near East Relief in Smyrna, has cabled the *New York Times*:"

"I hear, and firmly believe, many stories of Greek atrocities, and I have abundant evidence that the Greek army distributed enormous quantities of ammunition among the civilians in Smyrna and encouraged and organized sniping and bombing.

"I again urge Americans to believe that there is a divided responsibility for this terrible situation, and ask them to render succor in great quantity, not for any nationals or creeds, but in the endeavor to relieve the terrible suffering of helpless children."

Anyone who can become enthusiastic about any nation of the Near East is an exaggerated optimist, but in balancing lights and shadows, let us be intelligent and fair. By justice and truth and tolerance—thus the world shall progress.

Controlled Ventilation and Mine Fires

WHEN THE VENTILATION of a mine is natural, the occurrence of a fire in the upcast merely accelerates the ventilating current in the same direction. If it occurs in the downcast there is a tendency to reverse the direction of the downcast air current. If the ventilating head is too pronounced, the downcast air current will not be reversed and the gaseous products of the fire will be drawn downward. There is much uncertainty as to what will result under natural ventilation conditions where a fire occurs within the mine away from either inlet or outlet. The natural tendency is for the heated gases to arise wherever possible, as through connecting raises and stopes, and to follow the outgoing air current. However, the volume of heated gases may be such that less resistance is encountered through the inlet passage, the result being a reversal of the air current. As a consequence of this uncertainty, there has arisen in metal-mining practice a reluctance to do anything that would change the direction of the air currents after a fire has started.

Under controlled ventilation, the conditions are quite different. In practically all cases the established direction of the ventilation determines the spread of the gases, for whereas a fire burns slowly against the ventilating current, it spreads and burns rapidly in the direction of the ventilating current. In mining practice there has arisen a tradition that has been formulated into a dictum "never reverse the ventilating current." By a little thought the absurdity of holding tenaciously to this dictum becomes apparent. If the fire occurs on the outlet leg of the ventilating system, the workings between the fire and the outlet become filled with the gases produced by the combustion; that area becomes the dangerous zone. Clearly, to reverse the direction of the air current under such conditions would spread the gases in the opposite direction all the way from the fire to the outlet. On the other hand, if the fire occurs on the inlet side of the ventilating system, the danger zone extends to the outlet of the mine. By the prompt stoppage of the fan there is a decided probability that the heated gases will arise and escape through the inlet. By the prompt reversal of the fan, reversing the air current, the same conditions would be set up, only in greater degree. Thus, this is a specific case where the fan should be stopped at least, or, better, it should be reversed. If the fire occurs in the heart of the mine (assuming controlled ventilation), the half of the mine between the fire and the upcast (outlet) would be filled with gas and the other half safe.

What should be done in the event of a fire? One important controlling factor is the location of the fire in the mine. The right procedure then must result from a prompt and intelligent analysis of the situation.

The Argonaut Disaster

By T. A. Rickard

MY ANTICIPATIONS unfortunately proved correct: not one of the 47 men trapped by the fire in the Argonaut mine lived longer than four hours. Of two short messages left by them, one indicated that they died at about 4 A.M. The fire started soon after midnight. Apparently they tried to escape by climbing the ladders in the raises leading from the bottom levels and reached the 4350-ft. level, when they realized that the exit through the Muldoon shaft was closed to them by the smoke and gas that was being drawn by the fan. So they made a despairing stand against death and barricaded themselves in a cross-cut south of the 4350-ft. station. The barricade proved insufficient; the deadly gas entered; the men died quickly, and probably painlessly, falling on each other in heaps. Already a move is being made to learn something from the disaster that will serve to prevent the recurrence of another of the same kind. Mr. H. Foster Bain, Director of the U. S. Bureau of Mines, has telegraphed stating that in his opinion "the safety codes now prescribed by law are inadequate in not requiring for deep metal mines that there should be hoisting equipment to more than one exit, mechanical control and proper splitting of air currents, and provision for their reversal in emergencies". At the Argonaut the draft could have been reversed without reversing the fan itself—it had only to be stopped, by pressing a button. Then the heat of the fire in the main shaft would have caused the air to ascend in that shaft, and thereby would have drawn fresh air through the Muldoon shaft.

Mr. Bain refers to the hoisting equipment. The Muldoon shaft, the secondary exit of the Argonaut mine, was equipped with a hoist that operated only down to 800 feet. The remainder of this exit, consisting of a series of linked raises, drifts, and cross-cuts, was provided only with ladders, probably not in the best of repair in places. To ask men to climb 5000 feet of ladders through tortuous workings is unreasonable. Even a strong and active man could not have climbed from the 4800-ft. level to the surface, through the Muldoon, in less than six or seven hours, always supposing that the ladders were in good condition—a supposition open to doubt. Mr. Will J. French, chairman of the Industrial Accident Commission of California, has stated publicly: "The safety orders require a second means of egress starting 500 feet from the bottom of the mine. The Argonaut second exit started 150 feet from the bottom. The Muldoon shaft constitutes the second exit. It runs down to the 2400-ft. level From there down to the 4650 level are connecting manways separate from the main shaft, fully complying with the legal requirements". Perhaps they do; but they do not comply with the requirements of experience in mining. The Muldoon is sunk on the vein to 800 feet, then comes a cross-cut of 200 feet, below that a winze of 1300 feet to the 2400-ft. level. Yes, it "runs down to the 2400-ft. level" if one is not too fussy in the use of words, but it is not a continuous shaft; it is a series of linked workings, without a hoist after the first 800 feet, and entirely inadequate as a ready means of escape from the bottom of a mine nearly a mile deep. Below the 2400-ft. level the secondary exit becomes a winze to the 3300 and then another winze to 3900; below that a further series of winzes and raises, joined by the levels, connects with the bottom levels, where the men were working on August 27.

The Kennedy mine is not much better equipped in this regard; it also has a secondary exit that consists of a shaft that goes down only a small part of the way and is linked with a series of raises connecting the lower levels. Indeed, the obvious method of safeguarding the men in the lower workings of both mines is to connect the lower levels of the two mines, and thereby enable the two main shafts to be used in common as a means of egress in times of trouble. Unfortunately the two companies have been at loggerheads for many years, therefore there was no inter-communication along the lower workings, so that in case of fire in either mine the men in them had to seek escape by means of the difficult line of ladder-ways. Obviously, the Mining Engineer for the Industrial Accident Commission should have insisted upon the maintenance of communication between the two shafts. Unnecessary trespass from one mine into the other could have been checked by a bulkhead or door sufficient for the purpose, but one that could be broken or removed at a time of peril. The last official inspection of the Argonaut was made on April 9, 1922, by the Mining Engineer of the Industrial Accident Commission. He, says Mr. French, "found the general safety conditions to be good". This sounds satirical, but it is not meant to be so. Apart from humane considerations, it would be evident to any mining engineer of experience that the two companies owning the Argonaut and the Kennedy mines could operate more economically as a unit, instead of exploiting a small extent of orebearing ground by means of separate workings that have reached a depth that is out of proportion to the length of their stopes. I have no doubt whatever now that the logic of circumstances will compel a consolidation of the two properties. When this is done the two shafts will be connected and good ventilation will be established by the circulation of air from one shaft to the other. My opinion is that the Mining Engineer or the Safety Engineer, representing the State authority, could have insisted on this step long ago, and certainly after the fire of 1919, which proved so disastrous to both mines and so dangerous to the men working in them. Even in Mexico such inter-communication is compulsory under the law. No regulations can cover every contingency and no law will apply equally to the varied conditions existing in different mines; what is needed is not more legislation but more authority—particularly moral authority. That will be brought to bear on each problem if the right kind of man is chosen to enforce the regulations, and if he is backed by the enlightened public opinion of the mining community. It would prove an inexpensive precaution in behalf of those that go down the mine in skips and see the wonders of the deep if a salary large enough to be honorable were paid to such an inspector, and, needless to say, the wise enforcement of the regulations would prove a factor of economy in the long run even to the mining companies, because one disaster such as that at the Argonaut represents a staggering blow to the finances of any enterprise. Safety precautions are not only humane but economical in the long run.

DISCUSSION

The Prospector Protests Again

THE EDITOR:

Sir—Discussion of mining problems is great stuff, especially for prospectors. Some of them are great men, some are very poor ones, and others would be rich if they could turn their knowledge into money. The same applies to engineers and mining experts.

I have been reading the last two items of what Mr. Winchell said about the prospector, and naturally as a prospector I should have quite a disliking for this gentleman; but no, I only feel sorry for him, as Mr. Michael Merrick states in his article in the July 29 issue. New discoveries are made on ground on which great men have stood with both feet, worked their brains to their full capacity, and still did not see the $2,000,000 lying under them, only waiting to be found and developed. In general Mr. Winchell's statement does not add much to modern knowledge and the present mining man will only pass him up, and others like him.

What does he mean by exploration people having raked the country for mines and not been able to find a single one? Are they looking for mines with a Government guarantee of profit? If so they had better try to buy the United States Government mint.

To my opinion, mining today if properly handled is the most interesting work on the globe, and finding a mine is the most cruelsome punishment that ever could be measured out to a human being called a prospector. Still he never lets out a whine—never tells his story to the world and asks for sympathy, but keeps on trying to find mines, even if he gets nothing out of them.

Some time ago a fellow came into a camp from the hills to look for a job, when a fellow asked him, "Why do you fellows look around the best part of the summer, prospecting?" and the only answer he got was "For you fellows to get work." Another prospector answered a question of an engineer and expert as to whether he ever found a real mine, with a quite well-placed answer, "If I could look through mountains I would have found more than one."

So better not condemn the poor old prospector even if he doesn't find a mine every day.

Wasilla, Alaska. PAUL HENRY HANSEN.

The Delinquent Engineer

THE EDITOR:

Sir—In your issue of Aug. 19 under the heading "Discussion" I have noted the letter of F. M. Wichman and fully indorse his opinion.

But there is more to be said. I personally know of a case in which a high-priced engineer was sent by one of the big steel companies to examine and report on an iron-ore deposit. He carried out his journey to the district, and, following the crude mountain trails on horseback, got uphill to about 1,500 ft. altitude, when he turned back, considering the trail too bad for transit, and condemned the district and deposit without seeing it. Personally, I have been over the trail, also on horseback, from the first 2,000 ft. altitude to about 4,000 ft., and did not consider the trail any worse than others I have traveled in other countries.

A rough trail in a desert part of the country will soon give way to good roads when the district is opened up.

Another failure of engineers coming to a new country is that they do not seek assistance from the archives of the nearest mining office or from local engineers who have worked and studied the grounds for many years. They fight shy of even letting it be known that they come for some specific purpose, and in several cases they have pledged the guides not to disclose their identity.

I have watched several of them in the field (unknown to them) and found that everything except the formation of the country interested them, and saw that they had not the slightest idea of how to set about to do justice to the task intrusted to them. They come for a day, sometimes for a few days, and go without leaving any trace behind them. They come and see, but not to study any particular ground which would occupy the attention of a conscientious engineer, who knows the country and its formation, and has spent sometimes weeks, sometimes months of hard work to arrive at a final decision. J. F. CARLOS ABELSPIES.

Santiago de Cuba.

Power Economy of Electrothermic Distillation of Zinc in Doubt

THE EDITOR:

Sir—Dr. Fulton's paper on "Electrothermic Dry Distillation of Zinc Ores" in your issue of July 1 is read here with great interest. The claimed high recovery of zinc on all types of ores—94 to 96 per cent—with a low power consumption of 1,400 kw.-hr. per ton of ore, has received especial attention. But in respect to the amount of spelter cast and to the power consumed per ton of spelter, some questions have been raised.

Dr. Fulton states that "no blue powder is formed," and "in this process the metallurgical conditions of the retort process are retained." Now, the conditions of the retort process are that a very considerable amount of blue powder is formed—i.e., blue powder coming from skimmings, retort samplings, condenser scrapings, and condenser chips. According to a recent article by W. R. Ingalls (issued in the April number of *Mining and Metallurgy*) the amount of this blue powder is about 35 to 50 per cent of the ore; or about 30 per cent of the spelter product of a furnace is derived from blue powder. In an eariler article by Dr. Fulton (*Chem. & Met. Eng.*, Jan. 21, 1920), he estimates the recovery of cast spelter by electrothermic dry distillation at 60 per cent. From another statement in that article (Table 2) the recovery of tapped spelter is determined as 42.7 per cent. These figures indicate that the re-

covery of 94 to 96 per cent indicates only the total recovery of spelter and byproducts together, the actual recovery of spelter—that is, commercial slabs—being only 60 per cent, or, when reaching the retort conditions, it may increase to 70 per cent. The byproducts formed have to be re-treated. Whether this is done by mixing them into the ore charge or by treatment in a separate furnace, the powder is subjected to loss in distillation a second time, which may make an over-all recovery of 94 to 96 per cent questionable.

When comparing the different electrochemical processes, the power consumption should be based upon cast spelter instead of zinc content of the ore. The electrolytic process requires 3,000 to 3,300 kw.-hr. per ton of produced cathode zinc. When melted and cast into ingots about 4 per cent of the zinc is formed into dross. In addition hereto about 1 per cent of the zinc is converted into zinc dust for the purification process (straight zinc ore or zinc-lead ore supposed), thus making the electrolytic power consumption 3,250 to 3,500 kw.-hr. per ton of slab zinc. The actual power consumption by the electrothermic dry distillation process, assuming 60 to 70 per cent recovered as cast spelter, should be 3,300 to 3,900 kw.-hr. per ton of zinc —i.e., the distillation process requires more power than the electrolytic process. This is based on 60 per cent concentrate. In the case of intermediate or low-grade ore the power consumption is still more in favor of the electrolytic process.

With regard to the electrothermic smelting process, the power consumed per ton of ore is actually less than 2,000 kw.-hr., including treatment of the returning blue-powder charge, thus making about 3,800 kw.-hr. per ton of zinc cast, based on 60 per cent concentrate.

Although the foregoing should indicate that the electrothermic dry distillation process does not seem to have any advantage as regards power consumption compared with the electrolytic process and the electrothermic smelting process, it should be appreciated that it is necessary to have full information as to the actual power consumption per ton of zinc cast and amount of blue powder formed.

ROBERT LEPSOE.

Svelgen, Norway.

Sawdust Precipitation of Copper

THE EDITOR:

Sir—Referring to the Bardt process of copper precipitation with sawdust, in your issue of Sept. 2, 1922, it may be of interest to note that while apparently sawdust precipitation has never been tried out in the United States, it has been patented for some time.

In the patent to Jumau, No. 930,968, Aug. 10, 1909, claim 1 reads as follows:

> The herein described process for obtaining pure copper from a solution containing salts of copper, which consists in subjecting said solution to heat and pressure in the presence of a suitable quantity of wood used in any form, such as sawdust, shavings, waste wood and the like.

Jumau states that it is the carbon monoxide which precipitates the copper, according to the reaction:

$$CuSO_4 + CO + H_2O = Cu + H_2SO_4 + CO_2.$$

In his patent, No. 924,076, June 8, 1909, he claims:

> The herein described process for obtaining pure copper from a solution of a salt of copper, which consists in subjecting said solution to the action of carbon monoxide, and simultaneously subjecting said solution to the action of heat and pressure.

Denver, Colo. WM. E. GREENAWALT.

Mexican Silver Production

THE EDITOR:

Sir—In the *Engineering and Mining Journal-Press* of July 22 the statement is made, on the authority of the Bureau of Mines of the Mexican Department of Commerce and Industry, that Mexico has produced somewhat more than 155,000 tons of silver. Since no mention is made of the kind of ton referred to, the above noted statement is inaccurate.

The most trustworthy figures available concerning Mexico's silver production are the following:

	Metric Tons of Fine Silver
1521 to 1600	2,812.00
1601 to 1700	9,538.00
1701 to 1800	32,488.00
1801 to 1900	58,138.00
1901 to 1921	39,007.76
Total	141,983.76

Reviewing the Mexican silver production during the last three years, consider the following figures:

	Metric Tons	Average Yearly Silver Price, Cents
1919	2,040.0	111.122
1920	2,068.9	100.900
1921	2,005.1	62.654

It is quite surprising that the silver production of Mexico should have kept up almost to even figures during the last three years, although the price of silver during 1921 decreased so considerably. Furthermore, it is to be noted that during normal times about 35 to 40 per cent of Mexico's silver production is derived from lead and copper ores. But during 1921 almost all activity of the copper producers of Mexico was suspended, and the lead output reached only 50 per cent of the preceding year. Besides, no new bonanza has been reported. How can this be explained?

For one thing, the period of political unrest in Mexico is a thing of the past, and silver producers have been able to operate, subject only to natural economic conditions. During the period of inflated war quotations, some big producers were able to mine and mill low-grade ores at a profit. They have, on account of the big tonnage handled, acquired an efficiency not known before in Mexico. Although silver prices have reached the level of pre-war times, some of the producers referred to have been able to keep up the output without serious loss. Most silver producers of this class will be able to work at a profit with silver at or around 70c. Eventually, however, quite a number of straight silver producers will have to give up the uneven struggle and close down. In some instances, low-grade production at a slight loss or at no profit has been kept up with a view of finding new orebodies of better grades. During the next two or three years, quite a number of silver producers will cease production.

To offset this decrease, it is to be taken into account that present lead prices have had a stimulating effect on lead producers, and with copper at or near 14c., it is to be assumed that some of the big copper producers will be able to resume operations. Therefore, the Mexican silver output for the next few years may be estimated at from 2,000 to 2,100 metric tons a year.

It must be borne in mind that within about eighteen months—certainly by early in 1924, if the United States Government keeps on buying silver—the limit of the amount set by the Pittman Act will be reached. This will release at least 55,000,000 oz. of silver a year to be absorbed by the open market.

México, D. F. PAUL X. STOFFEL.

Experiments in Electrical Prospecting—I

The Results of Field Work in Various Metal Mines in the United States and Canada Present Encouraging Practical Conclusions—Coal Also Subject to Satisfactory Tests

By Sherwin F. Kelly

In THE *Engineering and Mining Journal* of May 7 and 14, 1921, appeared a paper on electrical prospecting which was an abstract from the English translation of Professor Schlumberger's book, "Study of Underground Electrical Prospecting." This article described the development, by Professor Schlumberger, of the Ecole des Mines, in Paris, of his system of applying electricity to prospecting metallic ores. At the time of writing the book Professor Schlumberger was concentrating his attention upon a method which depended upon the passing of an electrical current through the ground, and observing its distribution. He had just noted the fact that in the neighborhood of pyritic bodies an electrical current seemed to be present, having its source within the sulphide mass. Subsequent experiments showed that this phenomenon could be used with more ease and simplicity, both of apparatus and procedure, than the first method developed. It is with this latter method, which Professor Schlumberger characterized as "spontaneous polarization," that I have been experimenting in the mining camps of the eastern and northern areas of the United States and in southern Canada. That the underlying theory may be thoroughly understood before proceeding to the description of the experiments, I shall start by reviewing the principles of the method at the risk of repeating some material which appeared in the first article.

Professor Schlumberger noted in the course of his experiments that in the neighborhood of certain sulphide orebodies an electric current seemed to be flowing toward the vein from either side. Further experimentation led him to develop the theory that this was due to the oxidation of the sulphide in question, and that electric currents flowed down through the vein from the zone of oxidation, out into the country rock, up to the surface, and back into the vein at and near the surface of the ground. Thus it seemed that such action would be confined to sulphide minerals that were oxidizable and presented a more or less continuous path for the electric current. Subsequent experiments have led Professor Schlumberger to believe in a slightly different explanation, which he has summed up in the following words in a recent communication to the Academy of Sciences in Paris (*Comptes rendus*, Vol. 170, 1920, p. 519): "Any mineral mass which possesses metallic electrical conductivity throughout a sufficient depth, and which lies underground in such a fashion that part of is rises above the water table, produces in the surrounding moist terrain electrical currents observable by the differences of potential which they produce." This electrical action is probably due to the activity of the dissimilar waters of the oxidation and cementation zones when in contact with the metallic mass.

To detect with accuracy the presence of electrical currents in the earth it is necessary that they be diverted to a measuring instrument by some sort of contact that will not polarize when touching moist soil. Metal electrodes, even when gold-plated, are not suitable. For this purpose Professor Schlumberger devised an electrode made of a porous earthen cup cemented to the end of a copper tube. Tube and cup are then filled with a saturated solution of copper sulphate containing an excess of crystals. The copper tube is then corked and slipped into a brass sleeve for convenience in the field, making the whole apparatus stand breast high. The upper end of the sleeve is arranged to screw into the base of the potentiometer, which is used for measuring electric currents. Two of these electrodes are connected by insulated wire about 200 ft. long, wound on two small reels arranged to be clamped, one to each electrode. The path of the current is as follows: Ground, electrode, potentiometer, wire, electrode, ground.

The potentiometer is contained in a small aluminum case about 8 in. square and 2 in. deep. It is sensitive to one millivolt, and measures not only the strength but also the direction of flow of the current.

The electrode bearing the potentiometer is carried by the operator and the other by an aide. When prospecting, the following procedure is used: A suitable distance between electrodes is chosen, say 25 or 50 ft., and two contacts are made at hazard and the direction of flow of the current is noted. The aide's electrode is then placed at the contact of lowest potential, or contact toward which the current is flowing. The operator then proceeds in the direction of flow of the current, makes contact, and again takes a reading. This is continued until a reversal of current direction is noted, whereupon the two then proceed to follow a line at right angles to the first, still going in the direction of lower potential. This is repeated until the point of lowest potential in that region is found; that is, the point toward which the current seems to be flowing from all sides. The operator is now above the apex of the vein, and the next step is to discover the strike and shape of the orebody in question. This can best be done by tracing equipotential curves about the center just discovered, which we shall call the "negative center."

An equipotential curve is a line which joins all points which are at the same potential difference from the center. That is, the distance from the center to the curve in question, which is always a closed curve, will vary inversely as the resistance of the rock through which the current passes: the drop of potential is greater in a given distance for a resistant material than it is for conducting material; so that in a resistant material, a given drop of potential will take place in a less distance than it will in a conducting material. Thus it will be observed that the equipotential curves in question will be elongated along the strike of the vein. They are in reality the "outcrops" of equipotential surfaces partly inclosing the vein beneath the surface.

The equipotential curves outline more or less regularly the horizontal projection of the orebody in question, and will be more closely spaced when outside of the orebody than when lying within or traversing it.

These equipotential curves are traced by placing the

aide's electrode in any convenient point near the center; the operator then feels about with his own electrode for that point which is at the same potential as the aide's; that is, the needle indicates no flow of current. The aide then puts his electrode at that point, and the operator repeats the process, and this is continued until the curve is closed, which it should be within a five- or ten-foot error.

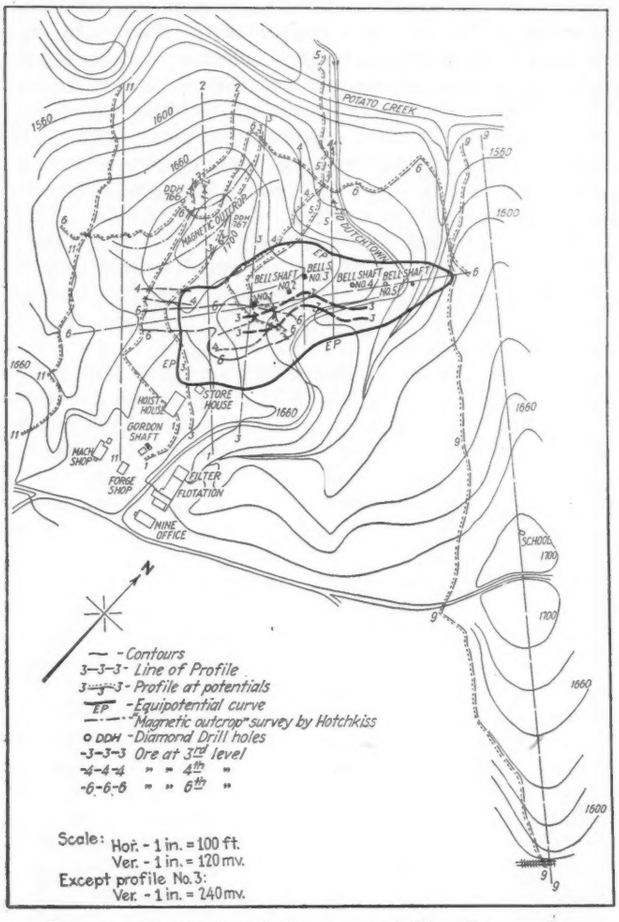


Fig. 1.—Equipotential curves at the Mary mine, Ducktown district, Tenn.

Further study may be made by determining profiles of the electrical potential across the strike of the orebody. To do this the aide places his electrode at a point 100 ft. or more distant from the vein being studied, and the operator makes contact with the ground nearer the vein, the distance between him and the aide depending upon the probable size of the mass. Such distance may vary from 5 to 100 ft. He then measures the difference of potential between the two points, whereupon the aide moves up, makes contact there, and the operator proceeds toward the orebody in a line at right angles to its strike, and repeats the process. This is repeated until the orebody has been traversed. As the orebody is the source of the electric current, this activity is manifested by a distinct peak in the graph of the potentials where the profile crosses the vein.

That is, the equipotential curves may be likened to contour lines of the electrical field, and the profiles to cross-sections thereof. A check is thus provided, as the profiles should indicate the same potential at the points where they cross the same equipotential curve.

I experimented with this system of electrical prospecting at the following camps in the summer and fall of 1921: Ducktown Sulphur, Copper & Iron Co., Ltd., Ducktown, Tenn.; Lehigh Valley Coal Co., Wilkes-Barre, Pa.; International Nickel Co., and Longyear Prospect, Sudbury, Ont.; Hollinger Consolidated Gold Mines, Ltd., Timmons, Ont.; Lake Shore mine, Kirkland Lake mine, Wright-Hargreaves mine, Kirkland Lake, Ont.; Coniagas mine and Nipissing mine, Cobalt, Ont.; and Calumet & Hecla mine, Calumet, Mich. At Calumet I tried both methods of prospecting, but at all other mines utilized only spontaneous polarization.

At this point I wish to acknowledge the kindness shown me by the engineers and managers of these various properties in permitting me to experiment on their orebodies, and the aid which they extended to me in making these experiments, often to the extent of disarranging their own staffs in order to assist me.

First Field Trials in Tennessee

The first region which I visited was the Ducktown basin, where I carried on an extensive series of experiments at the Mary mine property of the Ducktown Sulphur, Copper & Iron Co., and a shorter series on the Culchote Prospect of the Tennessee Copper Co.

The Ducktown region lies in an intermontane basin in the southeast corner of Tennessee near the North Carolina line. The rocks of the region are largely metamorphosed sediments of Cambrian age, consisting chiefly of sandy schists, graywackes, and mica schists. The beds have been highly metamorphosed and closely folded, so that at present they strike northeastward, and dip sharply to the southeast. According to Emmons and Laney, the orebodies, consisting principally of pyrrhotite, pyrite, and chalcopyrite, are replacements of limestone beds intercalated among the other sediments.

Although secondary enrichment has operated to a slight extent in most of these orebodies, the gossan is usually less than a hundred feet deep, and is limited at the base by a sharp layer of chalcocite, seldom more than a few feet thick, below which the sulphides are primary.

The experiments on the property of the Ducktown Sulphur, Copper & Iron Co. were conducted upon a lode branching to the northward from the Mary vein, slightly to the southwest of the shaft.

The depth of the primary sulphide below the surface varies from a hundred feet to a few feet where a gully crosses the vein and causes it to outcrop. On the hillside above the gully no outcrop is visible, but the dumps of several test pits show the presence of sulphides. This vein is served by the Gordon Shaft on the Mary mine, although one shaft, the Bell Shaft No. 1, was once put down to primary ore. (See Fig. 1.) Referring to Fig. 1 it will be noted that the equipotential curve outlines rather accurately the strike and shape of the orebody in question. To the northeast where the equipotential curve comes to a rather sharp point, the vein has been lost by faulting. Following the curve from that point toward the southwest, a noticeable inflection to the northwest occurs, corresponding to a similar bend as outlined in the orebody at the third level. This is followed by another bend to the south, also conforming with the trend of the vein. The decided thickening of the orebody toward the southwest as shown on the sixth level is marked by a corresponding thickening of the curve just before it turns to cross the vein.

The negative centers are not marked on this map,

because, although I located two, they were each in ore dumps about one of the Bell shafts, and therefore I ruled them out. Looking at the profile, it will be noted that No. 1 shows a marked inclination to rise toward the left or southeast on approaching the probable location of the Mary vein. Just before it crosses the next vein, it shows a rather sharp peak, which in my opinion is due to the presence of a cast-iron air line formerly used to ventilate Shaft No. 1, which the profile crossed just at this point. The rest of this profile, however, shows a marked elevation over the vein, and declines toward the northwest after leaving the vicinity of the ore. A very small hump occurs just before the point where it is carried on by profile No. 2. This is probably due to the low-grade sulphide material which was encountered near there between the inclined diamond-drill holes numbered 766 and 767.

Profiles Indicate Location of Orebodies

The other profiles, Nos. 3, 4, and 5, all show even more pronounced peaks where they cross the orebody. No. 5 was continued to the northwest to show the flat appearance of the curve when not in the vicinity of the orebodies. Profile No. 6 was run approximately along the strike of the vein, and is remarkable for the sudden rise in potential that it shows upon approaching the orebody (at the northeast end) after having traversed about 150 ft. of barren ground, which places the fault cutting off the orebody in all probability at about point No. 5 of this profile, or 200 ft. to the left from the point of commencement. The flattening out of this profile at its left end indicates to my mind either that it has departed from the course of the vein, or that the latter has become too deeply buried to make itself felt at the surface. Profile No. 9 crosses the same horizon as that upon which are located the Mary and Calloway mines, and about midway between them. The gentle rise of the profile may indicate deeply buried sulphides, or the feeble action at a distance of the two orebodies mentioned, or low-grade material. Of these explanations the last noted is probably the correct one. The small sharp peak was due to the presence of a cast-iron pipe buried a few feet beneath the surface, which was crossed at that point. The flatness of this profile in the northwestern part indicates that it does not cross the continuation of the vein first studied, and that therefore the faulting action, supposed to have taken place, carried the prolongation of that vein out of the region of experimentation.

The results from this series of experiments on an orebody showing no outcrop indicate that utilizing this method of electrical prospecting in an already partly developed region would prove valuable in locating veins that might otherwise escape observation.

A day was spent in experimenting on the property of the Tennessee Copper Co., not far from that of the Ducktown Sulphur, Copper & Iron Co., and whose deposits are of the same character. Here a profile was drawn across the strike of two veins located on opposite sides of a narrow gully, and an equipotential curve was traced partially around one of the veins. Lack of time prevented the closing of this curve.

The orebodies in this case, though practically unexploited, were known by four drill holes, one shaft, and two or three test pits. As is indicated by the profile, the Culchote orebody is larger than the Boyd. The peculiar shape of the completed portion of the equipotential curve is because, instead of being a simple ellipse about the Boyd vein, it would probably have the appearance of two parallel ellipses which have merged for a slight distance along their adjacent sides. Hence the east side of the curve, instead of closing to the north around the Boyd vein, bends back toward the southwest, probably to include the Culchote vein. These relationships are shown in Fig. 2.

Anthracite Coal a Conductor of Electricity

While attending the A.I.M.E. meeting in Wilkes-Barre, Pa., in the fall of 1921, I took advantage of my stay to experiment on anthracite deposits. A recent communication from Professor Schlumberger had informed me that he had discovered anthracite coal to be

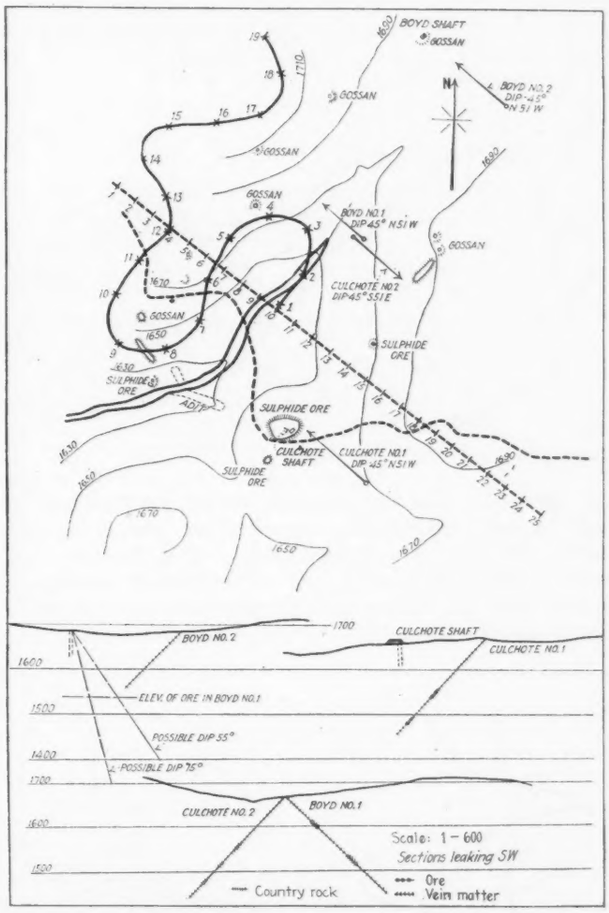


Fig. 2.—Equipotential curves at the Culchote and Boyd prospects of the Tennessee Copper Co.

Heavy black line is equipotential curve; dotted line a profile

not only a conductor, but apparently also a generator, of electricity. Through the kindness of the Lehigh Valley Coal Co. I was permitted to experiment near the Franklin colliery. The veins, varying from three to twelve feet in thickness, outcrop on the hillside parallel to the valley's axis, dipping sharply in toward it. The interbedded rocks are composed of coarse sandstone or grits, locally known as "conglomerate." Fig. 3 gives a cross-section of the veins across which the profile was run, as well as the profile itself. Some of the readings were variable, probably due to the use of electric haulage in the mines. The results clearly indicate, however, that anthracite coal gives a very definite electrical reaction which may be easily detected by this apparatus.

From Wilkes-Barre I proceeded to Sudbury, Canada,

where the officials of the International Nickel Co. kindly permitted me to carry on an extensive series of experiments on their No. 3 or Frood mine. This mine is about three miles north of Sudbury, midway along the eastern edge of the Nickel Basin, which is characterized by sandstones, slates, and tuffs, in the center, with a

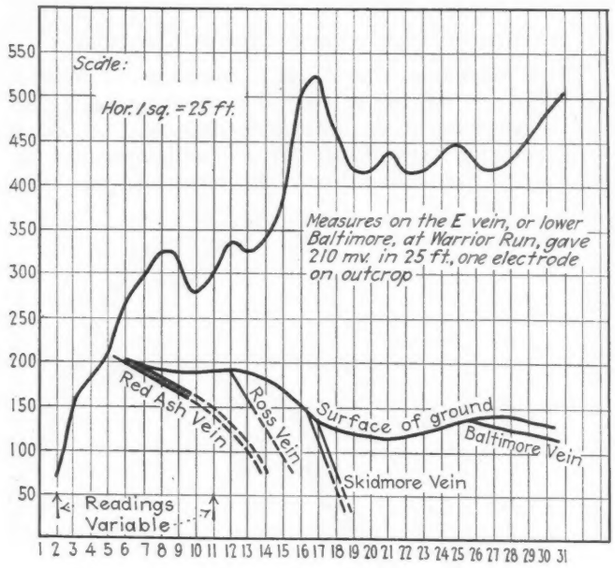

Scale:
Hor. 1 sq. = 25 ft.
Measures on the E vein, or lower Baltimore, at Warrior Run, gave 210 mv. in 25 ft., one electrode on outcrop
Red Ash Vein
Ross Vein
Surface of ground
Baltimore Vein
Skidmore Vein
Readings Variable
550
500
450
400
350
300
250
200
150
100
50
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Fig. 3.—Results of field work at the Franklin colliery of the Lehigh Valley Coal Co. (Red Ash, Ross, Skidmore, and Baltimore coal seams)

rim of nickel-bearing eruptive, which varies from a mile to three miles wide, the southern rim being the wider. This eruptive grades from acid on the inner to basic on the outer edge, the former being micropegmatite and the latter norite. It is this norite rock which carries the nickel values in the form of nickel-bearing pyrrhotite, the proportion being four of nickel to three of copper. The No. 3 mine is on a tongue of norite which is separated at the surface from the main body by granite and greenstone, and is bounded on the southeast by graywacke and slate. The outcrop forms a conspicuous ridge which rises about 150 ft. above the surrounding swamp land. This swamp land, however, is narrow, and granite hills occur to the northwest and graywacke hills to the southeast. The ridge shows very little vegetation, owing to insufficient soil. However, it has undergone intense weathering, and the rock in some cases crumbles in the fingers. The strike of the mineralized mass is northeast, and the dip is about 75 deg. to the northwest.

Fig. 4 illustrates the relation of the equipotential curve, the profiles and one negative center, to the main orebody. The extension of the equipotential curve to the northeast follows the outcrop, which has not been explored, owing to its narrowness and low value. In this region it will be noted that the profiles show sharp narrow peaks, thereby indicating a narrow mineral mass near the surface. The same observation may be made with respect to profile No. 6. Near this latter profile it was impossible to close the curve, as it apparently runs through the swamp. The swelling out of the curve to conform with the increased size of the orebody is markedly noticeable in the vicinity of profiles 3, 4, and 5.

Interpretation of Curves at a Nickel Mine

An interesting point regarding curve No. 3 is the sharp peak which it presents where crossing a dump of mineralized rock. The depressions about the middle of the elevated portions of these same profiles may be explained by the presence of lower-grade material at these points, positive centers, casings in the diamond-drill holes, or separate negative areas on each border of the orebody. These curves are marked by the broad, sharp elevations which they present, characteristic of large ore masses near the surface. Profile No. 1 also gives clear indication of a mineral mass beneath it. The several peaks on profile No. 2 are due to small outcrops of gossan which were crossed in the course of these measurements. Whether or not the general elevation of this profile is due to a broader underlying mineral mass than has been outlined on the map, or even suspected, I am not prepared to say without further experimentation.

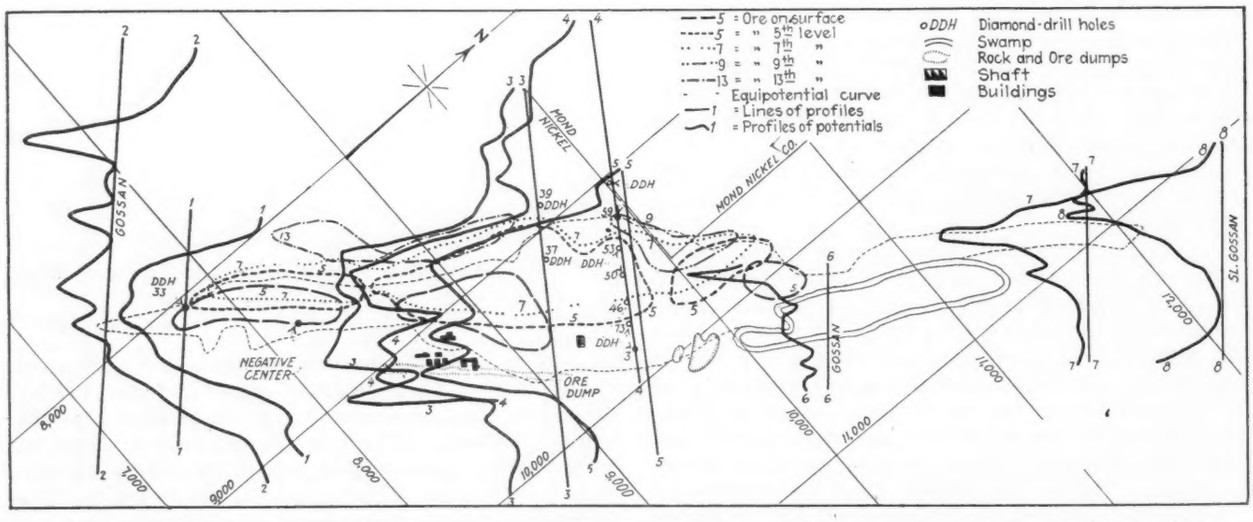
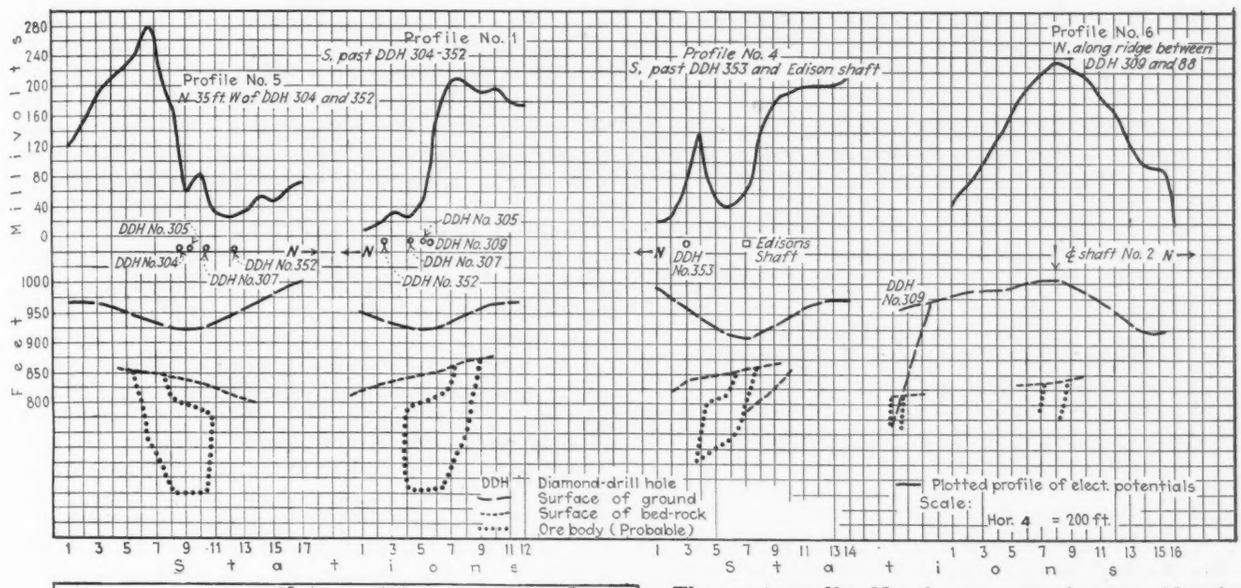


Fig. 4.—Relation of equipotential curves, profiles, and negative center to main orebody of No. 3 mine, International Nickel Co., Sudbury

While at Sudbury I also conducted some short ex-



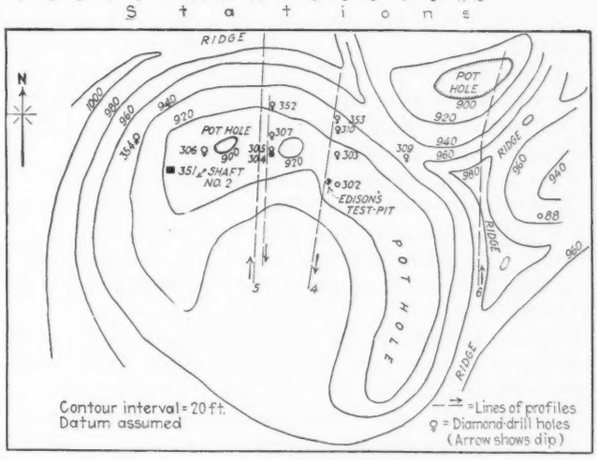


Fig. 5.—Profiles made at Mining Claim S-4136, Township of Falconbridge, Ont.

periments on the property owned by E. J. Longyear & Co. about fifteen miles northeast of the city. This property is practically undeveloped, one small shaft having been sunk on the vein. The bedrock in which the mineral occurs is completely hidden by glacial drift of typical pot-hole formation, the thickness of which varies from 50 to 200 ft.

Three of the profiles were run across one of the pot holes, and a fourth was run along a ridge separating two such depressions as shown by Fig. 5. Profile No. 5 was run about 35 ft. to the west of a line of drill holes, and a very pronounced peak occurs above the orebody. Profile No. 1 was run along the line of these drill holes, and also indicates distinctly the presence of an orebody. This profile should have been continued farther toward the south, but was not, owing to the brush. Its form indicates that it is likely that the orebody extends more to the south than is shown by the diamond-drill holes.

Profile No. 4 presents a narrow peak at point No. 4, which may be due to some small piece of metallic material lying on the surface, or to the casing of the near-by diamond-drill hole, if it was not pulled. The main peak, however, begins near Edison's Shaft, and continues to the south for some distance, leading me to believe that the orebody extends further in that direction, as I have indicated on the diagram. This profile also should have been continued a greater distance to the south.

The next profile, No. 6, was run along a ridge between two of the pot holes, and presents an almost ideal shape, in spite of the fact that there is 150 ft. of overburden on the bedrock. There are no diamond-drill holes here to give definite information on the underlying rocks, but hole No. 309, to the west, and hole No. 88, to the east, both struck ore.

The geologists of E. J. Longyear & Co. interpreted the evidence from these holes conservatively, and indicated the orebody as being narrow at these two points.

The height of the bedrock surface beneath this region I have interpolated from the holes on either side, and the probable width of the orebody I have indicated quite conservatively, as the aspect of the profile would lead me to believe that it may be even thicker than I have indicated in the sketch.

The most interesting conclusion from this series of profiles is that the electrical currents may make themselves felt through a thickness of nearly 200 ft. of overburden.

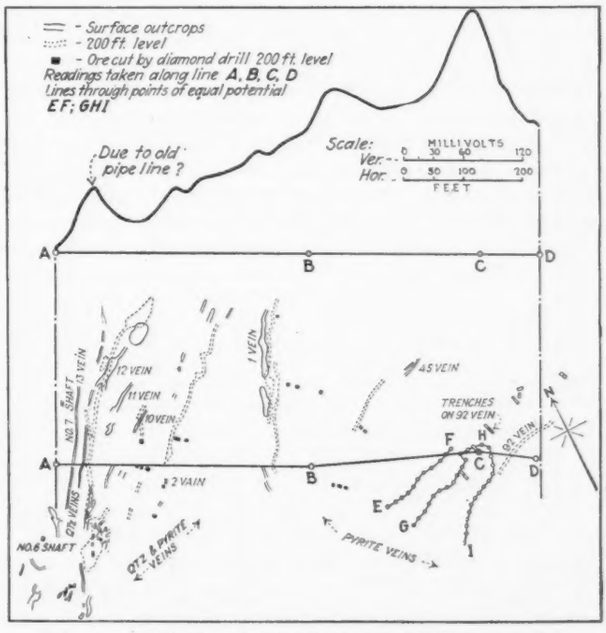


Fig. 6.—Effects obtained at the Hollinger mine, Ontario

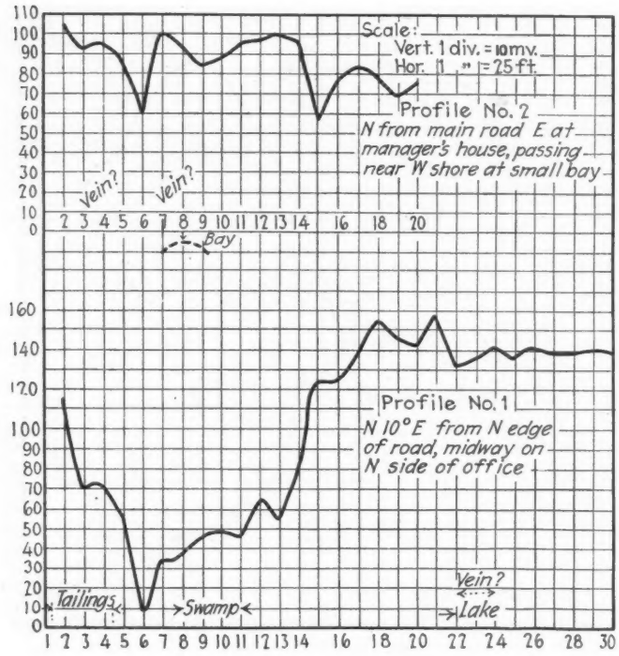


Fig. 7.—Profiles at the Lake Shore mine

Through the kindness of Mr. Scott, geologist for the International Nickel Co., I accompanied him on a short trip to the Porcupine, Kirkland Lake, and Cobalt camps, to the north of Sudbury. At Timmins, in the Porcupine camp, we experimented on the gold veins of the Hollinger Consolidated Gold Mines, with quite satisfactory results. The mineralization here consists of quartz stringers carrying auriferous pyrite and some free gold, these same minerals impregnating the wall rocks, which consist of diabase and greenstone. The quartz stringers occupy north-south fissures and may be of subordinate importance to the impregnation of the wall rock.

Referring to Fig. 6 it will be noted that, apparently, the veins to the west had less electrical effect than those to the east, due to the fact that there the wall-rock impregnation was less pronounced. The first peak after point A may have been due to the presence of a cast-iron pipe line lying along the surface. No. 2 vein produced a slight effect, as did the following one. No. 45 vein, crossed just after point B, produced a pronounced effect. No outcrop was visible along the line of the profile, but ore is known at the 200 level by means of a diamond-drill hole. The vein producing the most satisfactory effect was No. 92, which had been trenched at the surface and mined on the 200 level. It consists of strongly mineralized wall rock with a narrow quartz stringer. The equipotential curve G.H.I. indicates its trend from point C to the southwest, and it probably lies midway between the two limbs. This curve could not be closed, because doing so would have involved the possibility of trespassing on another company's property.

From the experiments on the Hollinger gold veins it may be deduced that Professor Schlumberger's method of electrical prospecting is applicable to gold ores when these latter consist of abundant disseminations of auriferous pyrite in country rock, but not when they consist of siliceous veins only, as will be noted from the results at the next camp visited. This was the Kirkland Lake gold area, where the mineralized veins are mainly siliceous replacements of shattered porphyry carrying disseminations of gold tellurides and auriferous pyrite. Experiments here were first made at the Lake Shore mine, and, as indicated by the profile (Fig. 7), there were no definite characteristics of the curve which could be ascribed to the presence of a mineral vein. This profile was carried out to the middle of the lake to see if an underlying mineral zone would make itself apparent through water. The negative results cannot be considered conclusive, because apparently this type of vein does not disclose itself anyway.

The second profile drawn presents one peak where it crosses a vein at point No. 7. This, though encouraging, cannot be regarded optimistically, because of the aspect of the rest of the curve, which, so far as known, crosses no other mineralized zones, except possibly about point No. 3.

These profiles, though apparently presenting marked irregularities, would, if plotted to the same scale as those at Ducktown and Sudbury, be nearly flat, and this must be taken into consideration when weighing the evidence that they present.

Profiles 3 and 4 (Fig. 8), drawn at the Ontario-Kirkland mine, show the same lack of encouraging characteristics. No. 4 was traced directly across an outcrop ten feet from where it had been exploited by a small open cut. The material showed practically no oxidation, and the individual grains were so thinly disseminated throughout the siliceous gangue as to preclude the possibility of a continuous metallic path being present. Profiles Nos. 1 and 2 at this same mine are far more encouraging. This is due to the fact that the mineralization, instead of being disseminated in a siliceous gangue, consists of pyritic material concentrated along the cleavage planes of a schistose gray-

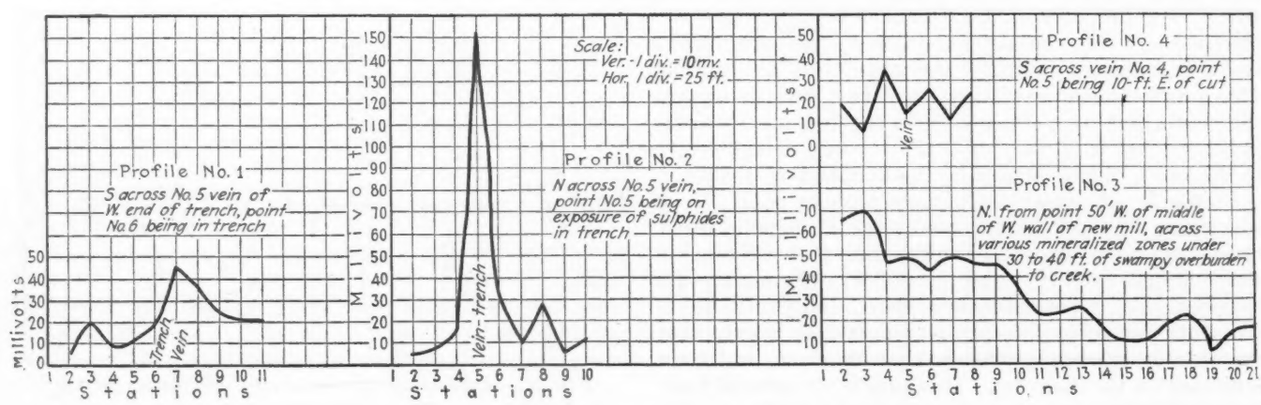

Profile No. 1
S across No. 5 vein of W. end of trench, point No. 6 being in trench
Trench
Vein
millivolts
Stations
Scale:
Ver. - 1 div. = 10 mv.
Hor. 1 div. = 25 ft.
Profile No. 2
N across No. 5 vein, point No. 5 being on exposure of sulphides in trench
Vein-trench
Stations
Profile No. 4
S across vein No. 4, point No. 5 being 10-ft. E. of cut
Vein
Profile No. 3
N. from point 50' W. of middle of W. wall of new mill, across various mineralized zones under 30 to 40 ft. of swampy overburden to creek.
Stations

Fig. 8.—Profiles at the Ontario-Kirkland mine

wacke. Here ample opportunity is given for any currents generated to travel in a continuous metallic path, and, in addition, the material was rather highly oxidized at the surface.

The remarkable sharpness of profile No. 2 when an electrode was placed on the sulphide outcrop is an excellent example of a characteristic profile for a narrow orebody coming close to the surface.

From the results at this camp it would seem that metallic disseminations in a siliceous gangue cannot be prospected for by this method, but the same minerals when deposited in a schist may easily be discovered.

To be concluded

Sodium Sulphide as a Differential Flotation Reagent

By J. B. Parker
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Sodium sulphide has been used as a flotation reagent for some time, and the remarkable results obtained through its use in sulphadizing and separating by flotation certain carbonate minerals from their gangue are familiar; however, as a differential flotation reagent it is not so well known, and a brief description of its use in that connection may be of interest.

There are several explanations for the action of the sodium sulphide when lead and zinc sulphides are to be separated. To me the most logical one is that this reducing reagent raises the surface tension of the pulp, and in addition the sphalerite adsorbs an active portion of the sodium sulphide more readily than the galena does. Controlling the amount of the sodium sulphide brings into play three factors: First, by using a limited amount of the reagent the galena is free to adsorb the oil; second, a sulphadized mineral requires a more intense flotation condition than one that is not; and third, the surface tension is changed and the change has a delaying affect on the flotation of the sphalerite.

In practice the following phenomena occur in connection with different ores with surprising regularity: Using a small amount of steam-distilled pine oil as a frothing and collecting agent, when an excess of sodium sulphide is added a froth carrying iron sulphides and very fine gangue will form, and when this condition has been reached the addition of any reasonable amount of different kinds of flotation oils will not produce an armored froth. The addition of copper sulphate in place of the excess of sodium sulphide will not only prevent the flotation of the minerals, but will also prevent the formation of a froth. When only a small amount of the sodium sulphide has been added, a froth forms which carries lead and iron, with small amounts of fine zinc and gangue. With this flotation condition (and in passing it might be remarked that there are several degrees of it), by the use of sulphuric acid and more oil the zinc may be floated.

Determine the amount of the desired oil that will produce a good collective flotation result without the use of any reagent. Then determine the maximum amount of sodium sulphide that may be used, by adding it until, upon the addition of the determined amount of oil, no galena or sphalerite will float. Now, by a number of trials determine the amount of sodium sulphide that may be used with the above amount of oil and which will allow the galena and sphalerite to float at the same time. With this determined amount of sodium sulphide and just sufficient oil to produce a froth, in most cases less than a drop, make a new test. There should be a decided differential action, in which case vary the amounts of reagent and oil, a little at a time, until the best results are obtained. Make all tests with material which has been recently ground with sodium sulphide to the same screen analysis and which has the same ratio between the constituents.

The grade and recovery of the zinc concentrate will be influenced by the amount of sodium sulphide and sulphuric acid used, as an excess of these reagents will float siderite. After the lead has been removed by the above method, add sulphuric acid until the effect of the sodium sulphide has been neutralized. The amount of acid necessary will depend upon the amount of sodium sulphide used and the ore. (The Star ore, an example having 15 per cent iron in the form of siderite, showed the presence of acid at the end of one-half hour when two pounds of acid per ton of dry feed was used. As one-half hour was sufficient for the flotation of the sphalerite, acid consumption was light.)

When the acid has neutralized the sodium sulphide, add an oil that will produce good results on the ore when no sodium sulphide has been used. I find the following mixture satisfactory in the majority of cases: 95 per cent Barrett No. 4 oil, and 5 per cent steam-distilled pine oil.

In the experimental stage this method is delicate, and, in addition to the necessary amount of tedious work, it requires patience and experience; but the commercial application is not so difficult to control as might at first be supposed.

In practice, add the sodium sulphide at the ball mill, agitator, or pump. The best results are obtained by allowing fifteen minutes' contact; then add the oil at the flotation machines. The recovered galena will be a product that will probably need cleaning, in which event some sodium sulphide should be used in the cleaner cell, and the cleaner tailing may be returned and combined with the feed before it is ground. Regrind the tailing from the lead rougher section with sufficient oil and reagents to produce a strong coagulation of the sulphides, and float for zinc. The zinc rougher concentrate will probably need cleaning also, and, if so, it should be returned and combined with the zinc section feed before it has been reground.

The same uniform conditions which are required in the flotation of a single mineral are required in the separation of two or more minerals, and in addition it is necessary to have the following factors under absolute control: First, the ratio between the constituents of the ore—i.e., lead, zinc, iron, and "insoluble." (This will be obvious when it is noted that the operator controls with his eye the grade of his products and the amount of concentrates to be made and that these concentrates are in the bin before his judgment is checked by the assays. His position is therefore untenable if the ratio of these constituents is constantly changing.) Second, the volume of the pulp. Third, the density of the pulp. Fourth, all mechanical operations, such as reagents and oil feeders, and water level in machines.

Where the gangue materials were such that it was not practicable to use acid, I substituted copper sulphate and soda ash with good results. I find that other combinations of sulphides, such as molybdenum and copper, moybdenum and zinc, lead and copper, copper and zinc, may be separated in much the same way.

The Marketing of Tin

Metal Mined Principally in Far East and South America—United States Most Important Consuming Country—London the Chief Marketing Center—New York Prices Reflect British Quotations Closely

BY J. H. LANG
Executive Sales Department, American Metal Co.

AT A DINNER recently I was asked to speak on the subject of "Tin Mining in the United States," and excused myself on the ground that there was no such thing. So far as the United States is concerned, I might, on the same grounds, have asked to be excused from writing this article, except for the fine distinction suggested in its caption between marketing tin and a tin market, for in no true sense of the word have we a tin market in this country. The only real market is in London. The Standard Dictionary defines a "market" as follows:

(a) A place where merchandise is exposed for sale.

(b) An open space or a large building in a town or city, generally with stalls or designated positions occupied by different dealers.

(c) A private store for the sale of provisions, as a meat market.

(d) A locality or country where anything can be bought or sold.

(e) A gathering of people for private purchase or sale as distinguished from an auction.

The only sense in which we can be said to have a tin market, or a market for any other of the non-ferrous metals, in the United States, is as described in paragraph (c), and, even so, the butchers have much the best of it. They at least take care not to kill their customers, whereas in the metal trades a whole army of potential buyers has been deliberately done away with. This colossal blunder occurred coincident with the era of trusts and consolidations which absorbed so many separate business units into giant combinations. The object sought was restriction of competition, regulation of output, and control of prices. To secure this control various arbitrary methods were adopted. Free and open markets were abolished, producers were to sell direct to consumers, and to nobody else, and at delivered prices only, and the consumers must not resell. This policy was economically unsound and legally indefensible, and it has been abandoned, but the damage it did lives after it. A market once destroyed is not easily or quickly rebuilt, and a broad, free, and open market for metals, which at one time existed on the New York Metal Exchange, has entirely disappeared, tin sharing in the common ruin along with copper, lead, and zinc. The ruthless destruction of this market to serve the interests of a few is one of the crimes of America's commercial history.

AMERICAN TIN-SMELTING OF RECENT GROWTH

Such as it is, the so-called tin market, at least so far as America is concerned, possesses several distinctive features compared with the alleged markets for other non-ferrous metals. Prior to the Great War no tin was produced here, and relatively little is produced at the present time. This has kept the metal free from the paralyzing clutch of various trusts and monopolies that at one time or another have infested the trade. There has never been any duty on imports of tin, and, as a consequence, it has been free to follow the foreign market, and everybody was, and at least so far as the imported article is concerned, still is, at liberty to deal in it unhampered by the numerous and vexatious restrictions which have killed trading in other metals.

Tin is one of the rarest of the base metals, and at the same time one of the most indispensable. Its chief use is as a coating for other metals, but its other uses are multitudinous and variegated. It accompanies man in every walk of life, literally from the cradle to the grave—from the time his childish hands receive their first baby rattle (made of tin) until his virtues are immortalized in imperishable bronze (made of tin and copper). It is a necessary ingredient of solder, and is a component part of most babbitt and other anti-friction metals, without which manufacturing and transportation would be impossible. As foil it wraps alike the workingmen's tobacco and the school girl's confections. It accounts for the rustle and lustre of silk so dear to the feminine heart, while the tin dinner pail has a place in politics and is celebrated in song and story. Without the humble tin can the world could not be fed.

Unknown to must of us, tin often finds a place in our "solid" silver, and our plated ware is largely indebted to it. Through its use for pipes in church organs it may occasionally inspire us to religious sentiments, regardless of what we think about it at other times. In the making of collapsible tubes, tin has rendered the world invaluable service, and in countless other ways it contributes to our comfort and progress as we journey through life. It is indispensable in the household, in medicine, in industry, and in the arts. No complete substitute has ever been found for it. In manufactured articles tin is generally used to the extent of a small percentage only (in tin-plates about 2 per cent), so that its price has very little influence on total costs, and it is in as great a demand at high as at low prices.

FAR EAST SUPPLIES BULK OF PRODUCTION

The total production of tin is about 120,000 tons per annum. The chief source of supply is the Straits Settlements, with a production varying between 50,000 and 60,000 tons a year. There are two principal smelters in the Straits—the Straits Trading Co. and the Eastern Smelting Co. It is the habit of these smelters to sell daily against their intake of ores, either by disposing of the metal direct or by "hedging" it on the London Metal Exchange. The next largest producer is Bolivia, which formerly shipped about 30,000 tons, and at present is shipping at the rate of about 20,000 tons per annum in the form of concentrates usually 60 to 70 per cent fine. Banca tin, which is produced in the Dutch East Indies (about 15,000 tons per annum), was, prior to the Great War, sold at bi-monthly auctions of about 2,500 tons each in Holland, and since the war has been disposed of by private tender in Batavia. Billiton tin, of which there is an output of 7,000 or 8,000 tons per annum, is now largely if not wholly smelted in the

Straits, and comes out as Straits tin. As such it is sold, presumably as produced, chiefly to London dealers, or "hedged" on the London Metal Exchange. Some ores from Banca are also smelted in the Straits, as well as ores from Siam, China, Australia, South Africa, Nigeria, and Bolivia. Except for some refined tin marketed by China and Australia—say 8,000 or 10,000 tons per annum—the balance of the output from these several last-named countries is shipped in the form of ores or concentrates to American, English, or German smelters, to the amount of 30,000 or 40,000 tons of refined tin per annum. Cornish production has reached a very low ebb, and is, of course, all taken up by English smelters. All of this tin, as in the case of Straits tin, is usually sold currently against ore purchases, or "hedged" on the London market.

London Chief Marketing Center

Dealers, merchants, and manufacturers resort to the same tactics, and this "hedging" practice gives rise to a large business which goes to swell the total of the London Metal Exchange, where there is also a large business in options—*i.e.*, the "put" and the "call" of tin, and "buyer's option to double," and "seller's option to double," which magnifies the turnover and insures there a ready market within a reasonable price range even when transactions are on a large scale. Prices in other countries, both producing and consuming, whether quoted in cents, francs, marks, or florins, per pound, picul or kilo, are all based on the London price per ton in pounds sterling converted at the current rate of exchange.

Of the total production of tin America takes more than half. Considering the absolute freedom of trade in this metal, we should have established a real market in this country, except for our own shortsightedness and stupidity—for in spite of the cleverness generally attributed to our business men, and the undoubted energy and initiative displayed by them in other lines, they have been singularly obtuse and unprogressive so far as our metal markets are concerned, which are conducted along the lines of the corner grocery and the country store. In fact, the comparison is a slander on the latter, which are often quite modern and up to date, whereas the metal trades of the United States have gone back to the Stone Age so far as methods of merchandizing are concerned. It is safe to assume that Noah provisioned the Ark with less bickering and haggling than goes on in New York every day over a few tons of metal.

If we can have real markets in wheat, corn, and cotton, why not in copper, tin, lead, and zinc? Our enormous production and consumption of all metals, our great wealth and rapid development, and our all-pervading energy and activity should make us the dominant factor in the world's markets. In fact, we are the dominant factor in spite of our handicaps. Particularly is this true because of what might be called our mercurial temperament. Marketwise we are never content to dwell in the living rooms of the house, but are always up on the roof or down in the cellar—always on the heights of optimism or in the depths of despair. Nowhere else in the world is so large a population with such vast purchasing power so closely knit together in its habits and modes of thought. From the Atlantic to the Pacific we read the same newspapers, books, and magazines; listen to the same phonograph records; witness the same picture plays and ride in the same automobiles. Our hats, clothes, collars, shirts, shoes, and socks are all of one pattern. Our cities and towns have a monotonous resemblance one to another, and Main Street and Market Street, where we live and do our business, are the same everywhere. En masse we are as alike as two peas in a pod, and we think more or less alike (when we do think), with the result that we are all "bulls" or "bears" together. It is an interesting study in mob psychology, but the net result so far as the matter in hand is concerned is that we make and unmake the metal markets of the world as certainly as the amount of fuel fed under a boiler regulates the steam pressure. Nevertheless, we persistently refuse to have any of these markets at home and insist on conferring all their benefits and advantages upon our English cousins.

This is peculiarly true of tin, where London stands between the producer and consumer, furnishing to both the only real market that exists in the world, using in the process that keen trading instinct and fine appreciation of values and the capacity and courage which come from long experience. In some quarters the simple-minded idea is entertained that by going direct to the source of supply and ignoring the London market the activities of the latter and its influence on prices will be curtailed. The ostrich has made himself ridiculous by adopting similar tactics, and he still keeps it up, though it has cost him much plumage, but as long as he can raise a fresh crop of feathers it is nobody's business to disillusionize him. Some day the trade may be educated to a point where it will realize the advantages of keeping our business at home, and using it to stimulate and develop a real market in this country, with all its machinery and its power and influence under our own control.

New York Market Follows Lead of London

All things considered, tin is sold cheaper in America than anywhere else. Nowhere else is competition so keen and nowhere else are the margins of profit (when they exist at all) so narrow. Anyone who does not believe this has only to go to France, England, Germany, Italy, or any other country to have the statement confirmed. Offers are cabled from London daily to agents and representatives on this side of the water to be sold on a purely commission basis. Minimum wholesale lots are five-ton quantities. Pigs of tin weigh close to 100 lb. each. There is no legitimate importing or merchandizing profit in the business. New York has no separate entity of its own in the tin market, but slavishly follows prices made in London. It is a bad case of the tail wagging the dog. Those who wish to deal in the metal, consumers or others who wish to resell, or "hedge," or in any way switch their deliveries or commitments, are compelled to meet this competition, with the result, as above stated, that by and large and over a period of times New York is the cheapest market in the world.

Five tin smelters are doing business in the United States. They are the tin smelter of the American Smelting & Refining Co., at Perth Amboy, N. J.—the only electrolytic tin refinery in the world; the Williams Harvey Corporation smelter, at Brooklyn, N. Y.; Richards & Co., at Malden, Mass.; the Andes Electin Co., at Brooklyn, N. Y.; and the Seaboard Metal Corporation, at Arlington, N. J.

Two important classes of tin are bought and sold in the United States. These are commonly known,

according to the specifications of the New York Metal Exchange, as Standard or Straits tin and 99 per cent tin. On contracts calling for standard tin, Straits, Australian, Banca, Billiton, American, and English refined tin may be delivered at contract prices. Other virgin refined also falls in that class provided it does not assay below 99¾ per cent tin. On contracts calling for 99 per cent tin any brand of tin assaying not less than 99 per cent approved by the New York Metal Exchange is good delivery.

Analyses of tin from various producing companies are given in the following table. Arsenic, bismuth, antimony, and lead are common impurities:

TYPICAL TIN ANALYSES

	Tin	Antimony	Arsenic	Lead	Bismuth	Copper	Iron	Silver	Sulphur	Cobalt
American electrolytic tin	99.928	.002	.002	nil	.042	.026	trace	....	....	....
Banca tin	99.950	.007	nil	trace	nil	.018	.045	nil	trace	....
Billiton tin	99.960	.006	nil	nil	nil	.023	nil	nil	nil	....
Penang tin	99.939	trace	.013	trace	nil	.016	.028	nil	.004	....
Singapore tin	99.870	.008	.045	.034	.003	.052	.003	.006	.005	....
(a) Mount Bischoff	99.795	.015	.063	.037	.005	.035	.042	trace	.008	....
Pyrmont tin	99.938	.017	.019	trace	nil	.022	trace	nil	.004	....
Irvine Bank	99.580	.062	.034	.221	.025	.126	.002	.018	.004	....
Mellanear, Lamb & Flag	99.19	.16	.06	.16	.35	.06	.02	....	....	....
Williams Harvey Corporation No. 1	99.860	.015	.040	.004	.005	.047	.003	nil	.006	....
Williams Harvey Corporation No. 2	99.560	.166	.037	.162	.007	.050	.005	trace	.013	....
Williams Harvey Corporation No. 2a	99.350	.245	.065	.223	.015	.042	.016	trace	.013	....
Williams Harvey Corporation No. 3	99.200	.300	.037	.396	.007	.100	.013	.014	.006	....
Williams Harvey Corporation No. 4	99.941	.011	.022	trace	.001	.020	trace	trace	.005	....
Penpoll No. 1	99.720	.118	.054	.041	.007	.052	.004	.009	.007	....
Penpoll No. 2	98.710	.569	.042	.546	.055	.103	.007	.015	.004	....
Penpoll No. 3	99.300	.325	.056	.212	.050	.088	.002	.021	.009	....
Redruth	99.160	.176	.053	.177	.017	.445	.041	.006	.008	.012
Sutton, T. & Sons	99.550	trace	.022	.342	.015	.045	.010	trace	nil	trace
Chinese No. 1	99.343	.031	.040	.434	.007	.052	.010	trace	.011	.072
Wing, Hong & Co. No. 2	98.662	.039	.035	1.035	.012	.134	.014	trace	.011	.058
Wing, Hong & Co. No. 3	95.280	.381	.050	3.995	.020	.106	.026	.018	.008	.116
(a) The company's directors issue the following analyses	99.847	.015	.015	.042	.001	.017	.063	....	....	....
	99.90	....	....	.05	.01	.006	.01	.008	.005	.04

The yearly average prices of tin since 1895 as given by the *Engineering and Mining Journal* follow:

Year	(a) New York	(b) London	Year	(a) New York	(b) London
1895	14.05	63.333	1909	29.725	134.774
1896	13.29	59.496	1910	34.123	155.308
1897	13.67	61.400	1911	42.281	192.353
1898	15.70	71.204	1912	46.096	209.420
1899	25.12	122.429	1913	44.252	201.679
1900	29.90	133.575	1914	34.301	(c)156.564
1901	26.74	118.633	1915	38.590	163.960
1902	26.79	120.720	1916	43.480	182.096
1903	28.09	127.320	1917	61.802	237.563
1904	27.99	126.733	1918	(d)	380.138
1905	31.358	143.083	1919	63.328	257.601
1906	39.819	180.646	1920	48.273	295.866
1907	38.166	172.638	1921	28.576	165.265
1908	29.465	133.124			

(a) 99 per cent grade in cents per pound.
(b) Standard tin in pounds Sterling per long ton.
(c) Average for nine months. No quotations during August, September and October.
(d) No average computed.

London's pre-eminence is due to the inherent ability of the English to trade, and they have the advantage of many years' growth and standing. Great intelligence has been shown in fostering and protecting the market there. Originally it was established for Straits tin, mined and smelted under the British flag. Banca tin (which is a Dutch product), or any other kind of tin for that matter, was not, until a few years ago, a good delivery under the rules and contracts of the London Metal Exchange. It was not until supplies of Straits tin became so limited as to make the market susceptible to control and manipulation, rendering it extremely hazardous to trade, and threatening the good repute if not the very existence of the market itself, that the rules were changed and the present "Standard" contract was introduced under which any tin running 99 per cent or better is a good delivery, thus greatly broadening the basis of trading. The same thing has been done in copper, lead, and zinc, so that England, though producing and consuming relatively little of these metals, is a factor always to be reckoned with in the world's markets, because there is the only market in which the world can trade, and it goes there to trade—America along with the rest. London derives the larger part of its business and almost the whole of its inspiration from the United States, and we do not get so much as a split commission out of it. And this condition will hold so long as our present archaic and obsolete policy is continued.

Nothing herein is to be construed as critical of the London Metal Exchange. I am simply voicing a desire for the restoration of the New York Metal Exchange to its proper place in the metal trades. At one time we did as much business on our Exchange as is done in London. Its rehabilitation would supplement and not supplant London. It would enormously broaden the market for metals all over the world. Copper would not have become unsalable and American mines would not have been closed and $100,000,000 of credit would not have become "frozen" if we had had a real metal market in this country. It would make stocks at all times liquid and convertible; it would stabilize prices, minimize fluctuations, and lessen the hazards at present attending the business, all of which should peculiarly appeal to those interested in tin. It is the compression of so large a volume of speculation within the narrow limits of the London market that gives rise to the wide and erratic fluctuation for which tin is notorious. We shall never have a real tin market in this country, or a real market for any other metal, or take the place to which we are rightfully entitled in the world's trade in metals, until the New York Metal Exchange is once more performing its proper functions in connection with the great industry it represents. The machinery is all there. Why not use it?

Fifteen Million Tons of Powdered Coal Burned in United States Annually

In a paper on "The Utilization of Powdered Coal," by J. Thomas Dovey and George N. Calkins, published in the *Bulletin* of the Canadian Institute of Mining and Metallurgy for September, it is stated that the consumption of powdered coal in the United States at present is about 15,000,000 tons annually. Of this amount, approximately 10,000,000 tons is used in the cement industry, in rotary kilns. In this industry, powdered coal, on account of temperature and output being under complete control, has practically supplanted all other types of fuel. Of the 110 cement plants operating in the year 1916, ninety-one were using powdered coal, seventeen oil, and two gas or oil and gas.

Proposed Pyritic Smelting in a Reverberatory

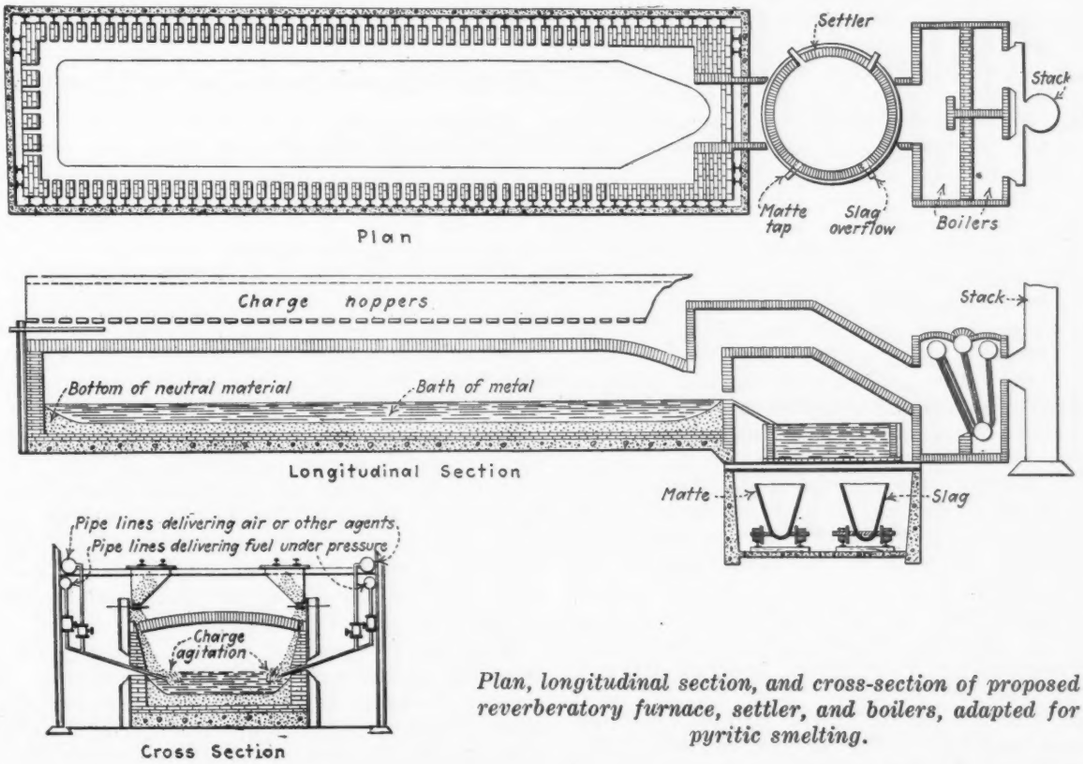
Air Pipes Introduced Through Side Walls of the Furnace Combine Converting Action With Ordinary Smelting Process—Fuel May Be Similarly Introduced If Necessary—Continuous Slag and Matte Overflow Provided

BY E. C. KING

PYRITIC SMELTING has developed from roasting, through two-stage matte smelting, to the present practice as carried out, for example, at Mount Lyell, of producing a high-grade matte from a high-sulphur ore with a minimum amount of fuel, in one passage through a blast furnace. Many metallurgists have admitted, however, that the blast furnace is not well suited to the process. All writers agree that one atom of the sulphur in pyrite, FeS_2, takes no active part in the smelting operation, being driven off before the ore progresses far enough down the shaft of the furnace so that its fuel value may be utilized. Robert Sticht has stated that this sulphur represents one-sixth of the fuel value required in pyritic smelting. According to this authority, "of the 30 per cent of sulphur charged, only 36 to 38 per cent is burned at the focus as fuel." Were it feasible to burn the sulphur in its entirety, cokeless smelting would be accomplished. "It will, however, have to be accomplished in an apparatus differing very considerably from our blast furnace."

G. A. Guess has stated: "The amount of heat furnished by the coke corresponds to the heat carried away by the nitrogen, and gives an idea of the heat economies that would be effected if it were feasible to furnish a blast of oxygen or enriched air to the furnace."

According to Lewis T. Wright: "It has been demonstrated at Keswick, Calif., that the use of coke can be entirely eliminated, providing that sufficient blast is furnished to carry on the operation at a sufficiently rapid rate; even when the charge contains a large quantity of converter slag, flue dust, and furnace cleanings, if the flux is sufficiently acid, it is easy if suitable conditions are present, and singular that raw smelting is not more practiced."



Plan, longitudinal section, and cross-section of proposed reverberatory furnace, settler, and boilers, adapted for pyritic smelting.

In Mr. Haywood's experiment of increasing the blast and maintaining the coke at 2.5 per cent of the charge, made at Ducktown, Tenn., he stated that under the influence of the largest volume of blast possible under existing conditions, the tonnage treated increased surprisingly, and the slag and matte ran so hot that he thought the 2.5 per cent of coke used might be entirely eliminated.

J. Parke Channing has said that "As far as we can judge, coke performs no distinct metallurgical function, but is a necessary evil, endured to prevent crusts adhering to the furnace." According to a Mount Lyell operator: "Coke is not used for its fuel value but simply to keep the tuyères from getting hard."

These excerpts indicate that the opinion is generally held that no coke is necessary in matte smelting, from the fuel standpoint, provided the sulphur present in the charge, and the heat from succeeding reactions, are utilized. All agree that pyritic smelting, as practiced, is a sensitive operation, requiring coke to counteract

its imperfections, and incapable of utilizing as fuel the major portion of the sulphur charged. Furthermore, the oxygen and sulphur, and other elements that enter into the reactions, are not brought into the proper intimate contact at all times and at all parts of the furnace. Therefore the charge must be changed many times daily to meet changing conditions, and, whereas a 43-per cent matte may be the objective, as at Mount Lyell, the matte grade actually varies between the extremes of 15 and 70 per cent.

Various processes have been devised to accomplish pyritic smelting at the same time getting away from the inherent disadvantages of the blast furnace. Arthur Day has patented a process of charging fine ore under pressure into a converter. A Swedish process of charging coarse ore into a converter was tried out in a smelter in the United States in 1906 and proved satisfactory from a thermal standpoint, but failed because it was an intermittent operation. Experience gained from various work, and from a study of what has been done by others, has led me to a process for the direct smelting of native sulphides in a furnace of the reverberatory type. Experiments made some time ago produced surprising results. Hundreds of tons of ore and concentrates were treated by a means similar to that which I propose. This will eliminate all roasting, but will require the crushing of all ores to a size suitable for reverberatory smelting. Concentrates, of course, are already sufficiently fine.

In the furnace illustrated in the accompanying cut,[1] which I propose to use, the ordinary siliceous furnace bottom is replaced by a bottom of neutral or basic material, to avoid the possibility of chemical action on the furnace bottom in the slag-making process. The charge is delivered through continuous hoppers along the furnace walls, into a trough of which the furnace arch is the bottom. The furnace is fed through pipe openings, spaced as desired, through the furnace arch, which allows the charge to pass in automatically. The charge holes are accessible to the operator should any of the material stick. Port holes, spaced as desired, are constructed along the side walls, end walls, and bridge of the furnace, through which portable pipe tuyères protected by a refractory material are submerged into the bath of matte. Fuel, air, and other agents are delivered through these tuyères, separately or combined, as desired. The air not only affords the necessary oxygen for the desired reactions, but agitates and thoroughly mixes the bath so that the necessary reactions can take place to the best advantage, and so that the heat generated will be well distributed. Complex reactions, caused by varying conditions in different parts of a furnace, are lessened. The slag and matte constantly overflow into a forehearth or settler, so that the furnace proper is maintained at all times filled with matte at a definite level, with practically no covering of slag.

In 1907 Dr. Peters said: "Not many years ago most of us were afraid to carry liquid matte in reverberatory furnaces." After describing how most of the injury to the furnace bottom is caused by oxides of the metals formed in the roasting operation, and that the matte bath is actually a protection to the furnace bottom and of great service in rapid smelting, he said: "Matte . . . is a good conductor of heat, and, as the portions of matte in immediate contact with the fresh charge give up their heat to it, this caloric is constantly replaced by conduction throughout the entire matte pool." It is this property of matte to conduct heat rapidly that is utilized to the maximum in the process outlined.

No improvements of a radical nature have taken place in the smelting of copper sulphide ores since the reverberatory in its present form was introduced. With the present popularity of this type of furnace, it is not unreasonable to continue the efforts at pyritic smelting which have heretofore been made in blast furnaces, by trying the process in a reverberatory. Minor objections will no doubt be offered, and it is for the purpose of clearing these up, by discussion, that this article is published. The great possibilities for fuel economy should make the project well worth a trial, inasmuch as costly equipment would not be required, and should more than offset any difficulties which might crop up, but which would in time probably be solved.

[1]U. S. Patent No. 1,425,386, Aug. 8, 1922.

Electric Shovels Now Used at Chuquicamata

Steam-shovel mining of the Chile Exploration Co.'s big orebody at Chuquicamata, Chile, was discontinued in March, 1921, in favor of electric shovels because of the markedly higher efficiency and lower operating cost of the latter. In 1920 the average cost of operation of the steam shovels was 17.2c. per cu.yd., whereas the cost for the electric shovels in use was but 4.5c. According to *The Excavating Engineer*, this company now has in service two 225-B Bucyrus electric shovels equipped with 85-ft. booms and 8-cu.yd. dippers, and nine 103-C Bucyrus electric railroad-type shovels with 3½- and 4-cu.yd. dippers.

Until recently the mine was being worked on four 100-ft. benches known as benches "B," "C," "D" and "E," the first being the top bench. Experience with the first 225-B proved that a 50-ft. bench can be operated with greater economy, greater safety and considerably greater sustained output over a period of time than the 100-ft. bench. Consequently, the plan of operation has been changed.

When operating against a 100-ft. face the first shovel spent the greater part of its time side-cutting. In the process of changing this bench arrangement the first shovel, however, was put through a trial thorough-cut. This cut contains about 130,000 cu.yd. of ore and waste. The time consumed was from May 25 to Aug. 12, 1921, working on eight-hour shifts per day. The average output was 2.228 cu.yd. per shift, the highest shift being 2,763 cu.yd. in eight hours. The cut was 110 ft. wide, the height varying from 35 to 80 ft.

The second 225-B shovel was put into operation during February, 1922. It was erected on bench "C," and its first work was cutting down from bench "C" to the new inner-level and establishing a 50-ft. bench between old benches "C" and "D." The shovel cut down 47 ft. in 300 ft. This was done by blocking under the front trucks and keeping the rear trucks on the ground.

A constantly increasing efficiency of operation has been maintained. In 1921 the average output per shovel shift was 1,646 tons, whereas in February, 1922, it was 2,464 tons. The highest shift yet obtained, according to available figures now at hand, is 5,250 tons in eight hours working against a 45- to 47-ft. face. This material runs from 1½ to 1¾ cu.yd. per ton. The output noted above was made in March, 1922.

USEFUL OPERATING IDEAS

Use of Geophone in Locating Compressed-Air Leaks

An Arizona mining company recently demonstrated a new use for the geophone by successfully locating leaks in compressed-air lines which were buried under from 1½ to 2½ ft. of fine rock fill. The following information is abstracted from data sent to the Bureau of Mines by the superintendent of the mine, and published by the Bureau as *Reports of Investigations*, No. 2,380:

The company has two parallel main compressed-air lines, about one and one-half miles long, buried under an average of 2 ft. of fine rock fill. One of the lines is a 4-in. high-pressure (1,000-lb.) main, and the other line is a 10-in. low-pressure (90-lb.) main. The two mains are separated by a 10 to 30-ft. interval, and run from the compressor plant to the No. 2 shaft, where they are taken underground. A pump line is also buried in the immediate vicinity.

Several leaks, not audible enough to be located, were developed in the mains. Various methods were suggested that did not seem practicable to the management. Finally, the company obtained a Bureau of Mines geophone and experimented with it. The first tests were conducted while the pumps were running, and while there was noise on the concrete pavement, all of which caused so much vibration in the geophone that it was impossible to detect the leaks.

The second attempt was made at the close of the day shift, when the compressors were not operating and when the pumps could be shut down. The valves in the far end of the surface lines were closed, and the lines were pumped to full pressure (90 and 1,000 lb. respectively).

Geophone readings were then taken at 7 or 8 ft. intervals directly over the lines. Several leaks, some very large, in the high-pressure line, were audible with the geophone at distances varying from 15 to 30 ft. A considerable leak in the low-pressure line was found at a distance of 10 ft. After detecting the leaks, no difficulty was found in locating them exactly.

"At this time," said the superintendent of the mine, "we are unable to state how large a leak must be in order to be located under 2 ft. of loose fill by the geophone. The fill we worked over was quite loose and dry and seemed to be quite unfavorable for the work in question. However, we have no hesitancy in saying that the instrument is a valuable adjunct to our business."

Under date of June 10, he supplements this statement as follows:

"Our final observations, so far as air leaks are concerned, are that the instrument cannot be depended upon to locate the small leaks. I believe that we located everything of importance in our high-pressure line, and we located some large leaks in our low-pressure line. However, in the latter, there is a section which has been badly corroded, to the point of being full of pin-point leaks. Though the aggregate area of these pin holes is considerable we cannot locate the resulting leak."

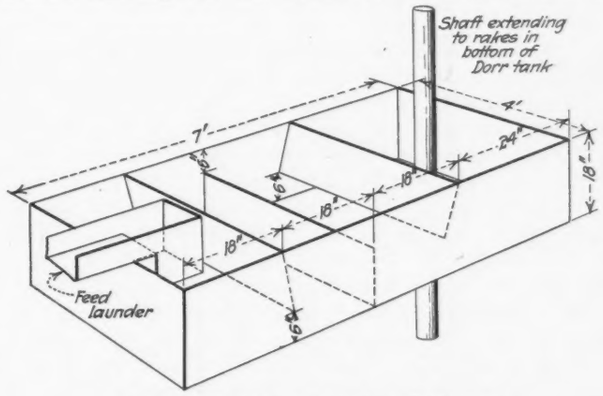
The delicacy of the instrument for listening purposes is demonstrated by the experience of this mining company. Obviously, the geophone will be found useful for many purposes in locating invisible unknown sources of vibration that transmit sound waves detectable by delicate instruments. The Bureau of Mines has recommended the use of the geophone for quickly locating faces of approaching workings where signaling by pounding on rock faces can be done; for locating mine fires; for locating entombed men; and for leaks in buried water mains. It is believed that many other practical uses will be developed.

The geophone used by the Bureau of Mines is an improved type of the French military geophone. The instrument and its uses are described by Alan Leighton in Bureau of Mines Serial No. 2,102, published as a *Report of Investigations*, March, 1920. Data regarding its use and manufacture also appeared in the *Engineering and Mining Journal*, March 6, 1920, p. 610; May 8, 1920, p. 1,054, and Sept. 18, 1920, p. 577.

Distributing Box for Dorr Thickener

BY C. G. DRESSER

The essential features of a distributing box used to feed a 40-ft. Dorr tank which thickens the feed to the flotation plant are shown in the accompanying sketch. Before working out the details of this box the tanks



Feed distributing box for thickener

had been fed through large sheet-iron cylinders with internal baffles arranged to decrease the velocity of the water. After the introduction of the box there was a marked improvement in settling in the tank, and the overflow was much clearer.

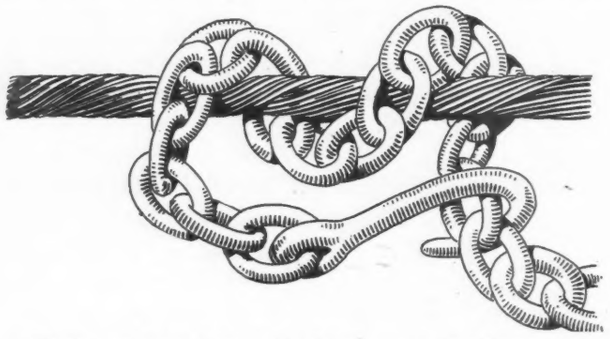
The idea of the device is to decrease the velocity of the water entering from the feed launder, and to spread this feed out so that no air bubbles are entrained in the descending water into the Dorr tank. A few bubbles rising on the outside of the feed box will agitate the water, bring slime to the surface, and thus decrease its capacity.

The box shown passes between 600 and 700 gal. per minute to the tank, and the overflow is practically clear. There is no sign of agitation around the outside of the box, the water being almost clear at this point. The baffles should be adjusted to dampen all eddies so that the feed will descend through the opening in the bottom in a smooth sheet. In the box illustrated this opening is 2 x 4 ft.

The box should be carefully nailed and supported by iron straps in order that it may not break apart and fall to the bottom of the tank, with consequent serious damage to the mechanism.

Chain Grip for Rope Haulage

In rope haulage with the ordinary clip on the lever or screw principle, when ascending a slope, there is danger that a full car will occasionally break away and slip down the rope when nearing the top of a steep incline, writes J. Chilton in the *Journal* of the Chemical, Metallurgical & Mining Society of South Africa. This is because the full rope near the bank head is of slightly less diameter than the same rope at the bottom of the slope. Consequently most rope clips have to be tightened when under this heavy strain. This entails extra expense in labor and often damages



Chain grip used for attaching car to haulage rope

the rope. To avoid these dangers and disadvantages at the Modder East it was decided to put in the chain grip attachment. This method of fastening is probably the simplest that could be employed.

Subsequent events have shown the wisdom of this choice, for neither with the full nor with the empty car has trouble been experienced due to slipping. The chains are attached to the front of the full car, and to the back of the empty. They are about 10 ft. in length with ⅜-in. links, and a hook at each end. One hook is attached to the draw-bar of the truck, then the chain is wound a few times round the rope and hooked back upon itself, as shown in the accompanying sketch. One of the chief merits of this method of fastening is that the pull is on the draw-bar, low down, and in the center of the road, thus avoiding the side wear on the wheels, which is so marked a feature in some forms of endless-rope haulages. The grip is also self-tightening and does not damage the rope.

When the chain grip was under consideration it was recognized that there might be some trouble due to the twisting of the rope if great care was not exercised in splicing the ends, but this drawback was successfully overcome, and after the first few cars were drawn up no further trouble was experienced from this source. Although there are two curves in the haulage, the chains and hooks pass round the sheaves without difficulty. The breaking strain of the chain is about three tons, and should a truck become derailed the chain breaks, thus avoiding damage to the rope. The diameter of the rope is ¾ in., and it travels over the tracks at the rate of two miles per hour. The attaching and detaching of the trucks at the three landings is done without interfering with the speed of the rope.

The Determination of Silver in Bismuth Metal

BY WALTER H. JACOBSON

As most assayers will agree, serious difficulties are encountered when the lead button to be cupelled contains a high percentage of bismuth. This is likely to be the case when a silver determination is made on bismuth metal. Some lead and tin refinery slimes are treated by separate processes for the concentration of bismuth, which always contains some of these precious metals. The following method gives reliable results if carefully carried out:

Weigh out 0.25 assay ton in a large-size beaker and fume with about 85 c.c. of sulphuric acid. Continue fuming for about five minutes to effect complete decomposition and solution of bismuth salts. Cool to the point where the white fumes (SO_3) cease to be emitted. Add with constant stirring about 450 c.c. 1-1 sulphuric acid very slowly, so that no splashing will take place. Heat slowly for about three-quarters of an hour. If this is closely followed out, almost all the bismuth oxysulphate will be dissolved. If not completely in solution, decant and fume the undissolved salts with 25 c.c. sulphuric acid, diluting to 200 c.c. with 1-1 sulphuric acid.

Pour both solutions into a liter beaker and cool to room temperature. Dilute to about 750 c.c. with distilled water and add about 1 c.c. of a saturated solution of sodium chloride to precipitate the silver. Filter and wash well with cold water. Dry residue and proceed with any fire method.

Ignition of Gas by Electric Detonators

Several ignitions of mine gas, which might have led to explosions, and at least one mine fire attributed to heated leg wires of electric detonators, have occurred at mines in which outside shot firing is practiced. Photographs taken at one mine indicated that the wires became red hot during firing. These results having been called to the attention of the electrical section of the U. S. Bureau of Mines, tests have been made to determine if possible the cause of the ignition and to aid in preventing future trouble of this kind. The report is given in *Reports of Investigations*, No. 2,383, published by the Bureau.

As a result of this investigation, the following preventive measures are suggested:

1. Connect the detonators in parallel-series, series-parallel, or straight series.
2. Limit the time length of connection to the firing supply to from 0.2 to 0.15 seconds.
3. Use electric detonators with copper leg wires.
4. Use a firing current supply having the lowest standard voltage that will satisfactorily fire all of the detonators as connected. For example, do not fire from a 600-v. circuit if 220 v. would be ample to give at least two amperes through every detonator.
5. Use an ungrounded firing circuit.

THE PETROLEUM INDUSTRY

The New Oil Pool at Tidioute, Pa.

Believed to Be of Moderate Extent—Gas Pools Found Near Corry and Meadville

Discoveries of oil and gas in northwestern Pennsylvania early in June, 1922, were deemed of sufficient interest to warrant sending a geologist to that region to gain first-hand information for answering queries concerning these new pools, according to M. E. Johnson in Bulletin 51 of the Pennsylvania Bureau of Topographic and Geological Survey. The pools were visited June 28-30.

Oil at Tidioute is nothing new. Back in 1860 oil was first discovered in this region and considerable production was obtained by sinking shallow wells to the Second and Third Benango oil sands. At that time wells a thousand feet in depth were considered to be very deep, and after two or three wells had been sunk to that depth without encountering any oil below the Third sand, it was taken for granted that no oil existed in the Tidioute region below that sand. Later, as the art of drilling was improved and holes were put down deeper and deeper, two or three holes more than 1,500 ft. deep were sunk in the vicinity of Tidioute. These holes were also dry and merely confirmed the opinion of most people that drilling below the Third sand in the Tidioute region was a fruitless undertaking.

The production of oil in the Tidioute region reached a maximum in 1866-67, when the Dennis Run pool was developed. Following that period production gradually declined until about 1904, when the Tidioute oil pool, which had been flooded previously, was unwatered by pumping and good production was obtained. Constant pumping of the wells since that time has practically exhausted the supply of oil in the Second and Third sands, but the wells are still pumped for the gasoline that can be extracted from the rich gas obtained.

In addition to the oil pools developed in and around Tidioute, gas was discovered in a deeper sand on Queen Creek about four miles southeast of the town. For want of a better name this sand was called the Queen sand. Wells in this pool encountered the top of the Queen sand about 700 ft. below the top of the Third sand. The sand averaged 100 ft. in thickness.

When Charles Carnahan decided to drill on the Siggins farm in the spring of 1922 (it is reported that a dream induced him to do it), he had perseverance enough to keep on drilling even though no production was obtained in the Third sand and for a depth of considerably more than 700 ft. below the top of that sand. The bit finally entered pay sand about 750 ft. below the top of the Third sand on or about June 1, 1922. The flow of gas was so strong at first that it sprayed oil all around the well. Production at first was at the rate of only 20 bbl. a day, but on drilling further into the sand, the production was increased to over 100 bbl. a day.

Since the Carnahan discovery well was drilled, many other rigs have been erected and holes put down.

PRODUCTION JULY 20, 1922, IN BARRELS

No. 1—Carnahan No. 1 well on Siggins farm.....	100
No. 2—Carnahan No. 2 well on Siggins farm.....	
No. 3—Carnahan well on Schoellkopf farm.....	30
No. 4—Clinger No. 1 well on Hunter estate.....	200
No. 5—Clinger No. 2 well on Hunter estate.....	400
No. 6—Carnahan No. 1 well on Jennings farm.....	30
No. 7—Carnahan No. 2 well on Jennings farm.....	250
No. 8—Carnahan well.....	300
No. 9—Carnahan well.....	drilling
No. 10—Brocklehurst & Kapp well on Yeager farm.....	dry
No. 11—White Oil Company well.....	60
No. 12—Hague and Company.....	dry
No. 13—Hawkey, et al.....	dry
No. 14—Carnahan well.....	rig up

The biggest well brought in to date is the Clinger No. 2 well on the Hunter estate. This well was reported July 17 as coming in at 800 bbl. The biggest reported production of the Clinger No. 1 well was 700 bbl. At the time the field was visited (June 28) the latter well was being deepened and was at that time making about 500 bbl. of high gravity (47.7 deg. Bé.) oil a day. The National Transit Pipe Line Co. was taking the production from all the producing wells. Recently this company has had to install a 3-in. line in addition to the two 2-in. lines already laid, in order to take care of all the production.

All of the producing wells are getting oil from the Queen sand. From data at hand it would appear that this sand is at about the same stratigraphic horizon as the well-known Clarendon sand. In the Starbrick well, put down just west of the city of Warren, the Glade sand was encountered at a depth of 67 ft. below the bottom of the pink rock and the Clarendon at about 167 ft. In the Clinger No. 1 well (listed above) the Queen sand was encountered at a depth of 200 ft. below the bottom of the pink rock. Near the town of Clarendon the producing sand (Clarendon) was encountered at a slightly greater depth, but in general the two sands seem to occupy about the same horizon.

Exposures are poor and infrequent in the vicinity of the new pool at Tidioute. Those outcrops seen, however, indicated a very gentle dip to the south. It is possible that there may be a terrace here in the widespread southward-dipping monocline of northwestern Pennsylvania and New York. If such were the case it would account for the location of the oil pool. Until further field work can be done, however, one can only hazard a guess as to the true reasons for its location.

The wells all start at about the stratigraphic horizon of the First sand (Venango group), this sand occurring near the top of the Devonian system. The surrounding hills are capped by Pottsville conglomerate. Boulders of this formation cover the hillsides and effectually conceal the rocks beneath the conglomerate. It is known, however, that there is an unconformity at the base of the latter in this region and that the strata below the conglomerate dip at a greater angle to the south than does the conglomerate itself. The Mauch Chunk formation is not present in this region.

All of the wells brought in to date are gusher wells flowing naturally at intervals when the accumulated pressure of the gas in the wells is sufficient to raise the column of oil in the hole. The oil is light-colored, greenish-yellow, and very similar in appearance to a

light-bodied lubricating oil. The gravity is 47.7 deg. Bé. As yet no use has been made of the gas which accompanies the oil.

It is believed that the newly discovered oil pool will not be of large extent. The oil sands in this region change in character very quickly, and it is thought that this characteristic of the sands would limit the pool to a small area even if structural conditions were favorable over a much larger area. Already the pool has been defined by dry holes on the south and northwest.

In the latter half of 1921 a small gas pool was developed about two and one-half miles east of Corry, Erie County, Pa., and half a mile south of Columbus, Warren County. This is in wildcat territory, hitherto thought unproductive. The nearest production of any importance is 25 miles away along the lake shore at Erie. All wells are about 800 ft. deep and small producers. The first well was drilled completely through the sand and was soon drowned out by water. The sand is only 3 ft. thick—probably a local stray—and it is probable that the pool will be very short-lived. At present five wells are producing and the gas is being piped to Corry. The wells start at a geologic horizon about one hundred feet below the base of the Pottsville conglomerate. No logs could be obtained of any of the wells, but the producing sand must be somewhere near the horizon of the Glade sand.

On June 14, 1922, a gas well was brought in on the E. A. DeVore farm, two and three-quarter miles south of Meadville, Pa. The well showed an initial rock pressure of close to 150 lb. and an initial volume of 900,000 cu.ft. It was brought in at a depth of 512 ft.

The well is only 200 yards west of a well which had been put down previously and pronounced dry. The whole region around Meadville has been pretty thoroughly punctured with holes, and it is thought probable that further drilling will not develop an extensive pool. A slight roll in the rocks near by probably accounts for the presence of gas at this point.

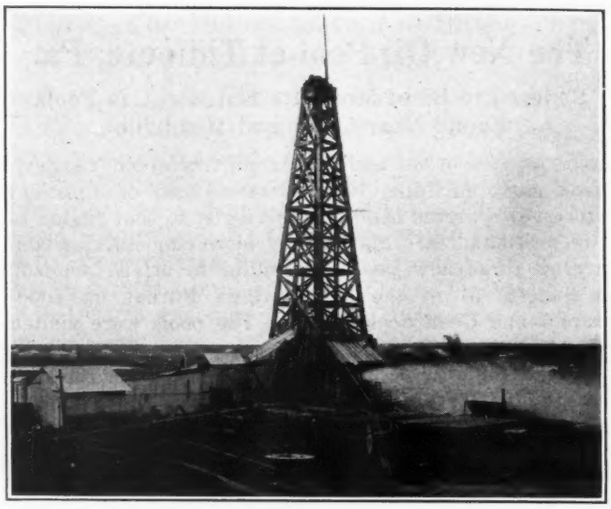
The well starts near the top of the Devonian, the producing sand being near the horizon of the Third Venango sand.

Prospecting for Oil in Queensland

BY OUR BRISBANE CORRESPONDENT

A second discovery proving the existence of oil in the state bore at Roma, Queensland, Australia, had just been reported when the last mail left (written Aug. 14). This bore, at a depth of 3,705 ft., in June, 1919, struck a heavy flow of gas, which on analysis was proved to contain 1½ pints of petrol per 1,000 cu.ft., and the percentage of oil was expected to increase under high pressure. The drill bit and a few feet of the stem had previously jammed in the hole through the breaking of the stem, and it was in the course of fishing operations for the lost tools that the petroleum gas was released. In a bore sunk earlier close by, a big flow of gas had been struck at nearly the same depth in a well put down by a private company. This gas ignited from the fire of the boiler operating the drill, and the fire was extinguished with difficulty. On an attempt being made to resume sinking in this bore the tools also here got irretrievably jammed, and the well was abandoned.

In the well the escaping gas, after it had been shut off, forced the obstructing implements up the hole 450 ft. Since then many weary months have been spent in fruitless attempts to move the obstruction further, and at length it was decided to deflect the drill from the original hole several hundred feet above the jammed tools, and by this means bore past them. It was while this work was in progress, under the supervision of an Australian driller, that the recent discovery was made. The new boring, going down 10 in. from the original hole, had reached a depth of 2,815 ft. from the surface, when a black, semi-liquid was skimmed



State well at Roma, Queensland

from the bore water, and this muddy substance, on being analyzed, was shown to contain over 35 per cent of oil. Thus, for the second time petrol has been proved to come from the Roma state bore—on this occasion at a depth much less than where it had been found in the escaping gas.

In neither this bore nor in the one sunk by the private company had signs of oil been observed at the shallower depth. It has now been decided to suspend boring temporarily, clear the hole of water, and further test the zone from which the oil has come, with the view of ascertaining, if possible, what are the prospects of the petroleum being found in commercial quantity.

An example of the humorous side of oil prospecting comes from Beaudesert, a farming and grazing center about 40 miles south of Brisbane. A bottle, containing a white fluid having a strong smell and the appearance of kerosene, and taken from a well intended to supply dairy cattle with drink, was submitted to the Minister for Mines, who instructed two geologists to investigate. These experts, after pronouncing the geological conditions of the Beaudesert country to be favorable for oil, had another sample of the oily liquid taken from the farmer's well under their own eyes, and this analyzed 95 per cent of kerosene and 5 per cent of lubricating oil. The geologists, knowing that it was not an unheard-of thing for kerosene to be found in nature, had the well pumped dry and sealed up for a fortnight, after which they took another sample for testing purposes, with the result that all traces of oil were found to be gone. The experts were then of course satisfied that the oil had not oozed from the surrounding strata, and, with the assistance of the analyst, were convinced that the refined oil had come from the ordinary four-gallon tin bearing the brand "Light of the Age Kerosene," while the lubricating oil had come from the pump. But some of the sanguine local residents were not satisfied, and several licenses to prospect for oil in the district have been taken out.

New Books

Three Books on China

China—Her History, Diplomacy, and Commerce. By E. H. Parker. Revised Edition. E. P. Dutton & Co., New York. $5.

A speaker discussing recently the futility of war and the ultimate uselessness of armies called attention to the historical fact that a dozen great empires had become pre-eminent in a military way only to be conquered and to fall into decay. On the other hand, the one great country that is the oldest of them all, and that has survived many so-called conquerings by the simple process of absorbing and assimilating the conquerors, never had an army, and has none now that is worthy of the name. That country is China. In the eighteen provinces that comprise China live about 450,000,000 souls—no one knows accurately how many there are. Neither has any one a definite knowledge of the resources of the country—except that they are diversified and huge, and that they are practically undeveloped.

Mr. Parker's book deserves careful reading by any student of China; and the subject is fascinating enough to attract everyone. The author believes that the traditional history of the country is insipid; he emphasizes therefore the period when foreigners first had relations with China. Mr. Parker lived and traveled among the Chinese for many years; he knows their religion, their literature, their laws, their personal characteristics, even their racial notions; and he explains them all in a very readable way. He knows the modern history of China and the exploitation of the country by the European powers and Japan. In general, he is frank about the grabbing tactics of foreign governments. He says, for instance, of Russia, England, and France, "these powers at least went through the form of asking before taking, and exhibited some small consideration for China's 'face.'" He slurs the United States by saying that we "have always been prone to pass as the good and disinterested friend of China, who does not sell opium or exercise undue political influence." He justifies Japan in 1914 in the formulation of "at first sight harsh and pre-emptory demands upon China," by saying that it was necessary for Japan's self-protection "in order to forestall Teutonic spite and intrigue and any future attempt of the tricky Kaiser to wrest from China by violence" further territory. It is unnecessary to consult the title page to find that the author is British; but the reader does not need to agree with all the opinions expressed, to appreciate the value of the real information with which the book is crowded. The new edition, like most new editions, has been, according to the cover, "thoroughly revised throughout," and three extra chapters have been added dealing with law reforms since 1905, the growth of the spirit of democracy, and the rise of the Chinese Republic. You should read it if you are interested in the Eastern question.

A. B. PARSONS.

The British in China, and Far-Eastern Trade. By C. A. Middleton Smith. E. P. Dutton & Co., New York. $7.

The author deals with markets, banks and exchange, shipping, mines, railroads, trading difficulties, and opportunities.

The New Atlas and Commercial Gazetteer of China. Edited by Edwin Dingle. E. P. Dutton & Co., New York. $160.

This contains twenty-five bilingual maps with complete indices, and is authentic and comprehensive.

Mineral Classification

Manual of Determinative Mineralogy. By J. Volney Lewis. Third revised and enlarged edition. John Wiley & Co., New York. $3.

A very brief introduction, on Crystallization, and Physical and Chemical Properties, brings the student to the practical methods of determination. Two methods are used: (1) Physical Tables, (2) Blowpipe Tables.

In the first method (Physical Tables) the general classifying tests are based on *streak* and *color* of minerals, with *cleavage* a third test. Luster is not used for classification purposes, but hardness is indirectly used. On account of the great variation in color of the "non-metallic" minerals, and the probable difficulty in determining cleavage, this method of classification leads to much repetition. In the second method (Blowpipe Tables) an elaborate introduction is given, covering apparatus, reagents, operations, and reactions of the elements. The apparatus described is usually of a simple type and the tables are constructed on the "elimination plan," requiring most methodical use. The classifying tests are based on *luster, fusion, blowpipe reactions* for the elements, and other factors. A great many useful hints are given in manipulation and systematic work. This method is naturally recommended by the author, especially in the case of the ores.

Students should find both sets of tables useful, but, as indicated by the author, must not omit "sight" knowledge of minerals or the broader relations generally given in Descriptive Mineralogies.

At the end of the book are found an auxiliary table based on crystallization, luster, and hardness; a useful glossary, and a list of abbreviations.

Among the advantages of the book may be mentioned the large number of mineral species covered and the concise and systematic descriptions of these minerals in the Physical Tables. It would have been desirable to have described, under apparatus, the gas-blowpipe and the Kraus-Jolly balance for specific gravity and to have given a more recent method of testing for molybdenum; but probably the author has had in mind the maintaining of the greatest simplicity in equipment and tests.

LEA MCI. LUQUER.

The Best Books on Iron and Steel

Messrs. Schwab, Unger, Crawford, Mathews and Corey, Jr., have selected the following books as of most importance in a business library, as representative of the iron and steel industry:

"Metallurgy of Iron and Steel," Stoughton.

"Manufacture and Properties of Iron and Steel." Campbell.

"Metallography and Heat Treatment of Iron and Steel." Sauveur.

"Principles, Operation, and Products of the Blast Furnace." Johnson.

"The Metallography of Steel and Cast Iron." Howe.

"Basic Open-Hearth Steel Process." Dichmann. (Van Nostrand.)

"Iron and Steel Works Directory of the United States and Canada." (American Iron and Steel Institute.)

"Principles of Iron Founding." (Moldenke.

"Blast-Furnace Construction." Johnson.

"Metallurgical Calculations." Richards.

"Electric Furnaces in the Iron and Steel Industry." Rodenhauser, Schoenawa & Von Vaur. (Wiley.)

All are McGraw-Hill books with the exceptions noted in parentheses.

Technical Papers

Illness from High-Pressure Air—The U. S. Bureau of Mines, Washington, D. C., has recently issued Technical Paper 285 on "Compressed-Air Illness and Its Engineering Importance." The bulletin is of forty-eight pages, and is one of a series dealing with the physiological problems arising in mining and underground engineering developments. It relates specifically to methods of overcoming the ill effects on men of increased atmospheric pressure, and reports the work done on this problem in the construction of the East River tunnels in New York. It may be obtained free on request to the Bureau.

Miners' Phthisis—The Department of Mines of Western Australia, Perth, has issued a ninety-nine page report on Miners' Phthisis in South Africa, obtainable on request. The bulletin is a very complete report on many different phases of the health of underground workers as affected by rock dust.

Tasmanian Mining—The report of the Acting Secretary for Mines for 1921 has recently been issued, and describes mining progress in Tasmania during the year. It is a pamphlet of ninety-two pages and may be obtained free from the Secretary for Mines, Mines Department, Hobart, Tasmania.

SOCIETIES, ADDRESSES, AND REPORTS

Institute Meets in San Francisco

Members Visit Plant of United Comstock at Gold Hill, Nev., the Hetch Hetchy Dam, University of California, Stanford University and Points of Interest on San Francisco Bay—Technical Sessions Well Attended

THE EASTERN MEMBERS of the American Institute of Mining and Metallurgical Engineers, headed by Arthur S. Dwight and F. F. Sharpless, who were on their way to the Institute's meeting at San Francisco, detoured from their route at Sacramento and arrived in Reno, Nev., on the morning of Sept. 22. They were joined at Reno by members of both the San Francisco and Nevada sections. Breakfast was served to all by the Nevada Section, and by 9 o'clock everyone was on the way to Virginia City, Gold Hill, and Comstock, the new village at American Flat below Gold Hill. The route was by the Geiger grade over the Virginia Range.

Arriving at Comstock, the party was divided, part being taken into the mine workings of the United Comstock Mines Co. through the adit and part visiting the new cyanide mill which is about to be placed in operation by the company. Luncheon was served at the company's boarding house, and during the afternoon those who had visited the mine inspected the mill. Late in the afternoon the party, accompanied by many Nevadans, proceeded to Gold Hill, and the visitors were entertained at a banquet by the company's officials. Bulkeley Wells was host.

Following the repast, a brief business meeting of the Nevada Section was held, and Bulkeley Wells introduced Governor Emmet D. Boyle. Governor Boyle extended felicitations to the audience on the reincarnation of the Comstock. He called attention to the fact that many technical details of mining had originated upon the Comstock and that the first federal mining laws had been sponsored by Nevada statesmen. He said that not only did Bulkeley Wells bring capital to the state, not only did he bring a competent technical staff, but he also brought a full conception of the human responsibilities involved in the important undertaking. He extended an invitation to the members of the Institute to come again to Nevada.

President Arthur S. Dwight of the Institute, who was then introduced, said that he welcomed the opportunity that had been given the Institute members through the initiative of the Nevada members. He commented upon the standards indicated by the development of the mine and the construction of the new mill as reflecting the character and standing of the engineers. He said that the success of the enterprise was assured. He told how, when he had charge of operations at Cananea, the Mexican Government co-operated with his company to the extent of cancelling all duties upon the machinery and materials used in the construction of the Cananea mill. He brought in two carloads of windows. The old Mexican official objected to the remission of the duties upon the windows. The official said that no building could have so many windows. Whereupon he was taken upon a visit to the plant and shown the empty spaces awaiting the receipt of the windows. "The wonder is," said the official, "how you got all those windows into two cars."

President William Sproule of the Southern Pacific was introduced by Mr. Wells. Mr. Sproule commented upon the interesting point that the pathetic city of the past should have become the prophetic city of the future. He said that the glory of the past gave bright promises for the future. Men of spirit, knowledge, and possessing the confidence of other men to such a degree that they could bring their massed wealth into Nevada and put it to work had initiated the enterprise represented by the United Comstock Mines Co. Instances like this served to dispel the false notion of the iniquity attached to wealth. He said that such an enterprise as this one could not have been accomplished by popular subscription. It could not have been done other than by tapping the sources of accumulated wealth. Failing to do that, most enterprises would either fail or not even be started. He said that thinking people must lead in a constructive program, as out of the accumulation of wealth by individual frugality would come the capital for the development of the state and its future prosperity.

Senator Key Pittman, Walter E. Clark, president of the Nevada State University; Mayor Stewart of Reno, and Senator Charles Henderson contributed to the addresses, and then Bulkeley Wells, in closing the meeting, introduced the individual members of his staff and their assistants.

Albert Burch presided at the mining sessions which were held at the Engineers Club of San Francisco on Sept. 25. Mr. Burch, in opening the

Market Street, San Francisco, at junction of Post, Montgomery, and New Montgomery Streets. Left to right—Crocker Building, First National Bank Building, and Wells Fargo Building

meeting, introduced Roy W. Kelly, who presented a paper on "Industrial Relations in the California Petroleum Industry." Mr. Kelly stated that one of the practical difficulties encountered in establishing the necessary contact between the directing personnel and the workers was the scattered divisions of the different parts of the industry. He pointed out the necessity for educational work and said that the problem of training men was a real problem. Most of the large companies in California had done and are doing something toward this objective, he declared. An investigation had shown that the "radicals" were in large degree men who had had little education. They were thus susceptible to unscrupulous leaders. In a short summary he stated that an objective of the industrial relations work was safety in industry and that it had to do with employment, education, housing and sanitation, transfers and promotions, the discovery of latent talent among workers, the handling of complaints, discharges, the investigation of the cost of living, the adjustment of wages, and safety inspection. He advocated medical examination of all workers and stated that this was being done by some of the petroleum companies. Mr. Kelly then presented a number of lantern-slide charts illustrating statistical data and followed these by an excellent moving-picture film showing intimately both living and working conditions in the oil fields. The distribution of petroleum products was also illustrated.

Geology of United Comstock Mine Described

Following the short discussion, Wilbur H. Grant read his paper on "The Geology of the United Comstock Mine." He briefly discussed the geology of the United Comstock mines, which embrace the southern end of the Comstock Lode beginning at the boundary line between Virginia City and Gold Hill and extending south to American Flat, a total distance of approximately 10,300 ft. along the lode. Over 1,000 ft. of the Lode at the north end of the property in question has been developed by five main levels and numerous sublevels. This work has been done in the Imperial mine. The Yellow Jacket, to the south, has been partly developed by the reopening of three old levels. A main haulage adit has been driven from Comstock in American Flat a distance of 9,250 ft. to the north end of the property. About 5,500 ft. of the adit length is in the foot wall of the Lode and parallel to it. In the Imperial mine, the country rock is highly altered andesite. Part of the lode has been mined, and the new mining work will consist of mining the stope fillings and such portions of the vein as had been left by the former miners. Mr. Grant stated that the best grade of ore is in the old fills. Much of the walls of the old stopes can be mined at a profit. It is anticipated that practically all of the ore to be mined lies above the adit level and will be in the vicinity of the old stopes.

California Street hill, San Francisco, at junction of Grant Avenue

"The Aztec Mine, Baldy, New Mexico," a joint paper by Charles A. Chase and Douglas Muir, was presented by Douglas Muir. Mr. Muir reviewed the history of the mine, which is interesting chiefly because of the fact that quartz veins and contact metamorphic deposits occur in association with sedimentaries which have been intruded by masses and sills of porphyry. The primary gold deposits are of two types, quartz veins and contact metamorphic deposits in calcareous sedimentary rocks. Most of the gold has been obtained from the quartz veins, which are closely associated with intrusions of porphyry. Owing to the abundance of sedimentary rocks, many veins appear to be wholly contained in them. A description of the geology, prospecting, mining, and milling was given by Mr. Muir. Mr. Muir said: "Of drifting, slope sinking, and similar work, a distance of 9,883 ft. was accomplished during the years 1918-1921, at a total cost of $15.89 per foot. During the same period, diamond drilling aggregated 18,276 ft., at an average total cost of $4.59 per foot, including sampling and assaying. With the exception of two small orebodies and two large high-grade orebodies, an unprofitable one, and a few scattered high assays, nothing substantial was accomplished by this exploration."

At the conclusion of the luncheon which followed the morning session Chairman Burch introduced President Dwight. President Dwight said that one of the problems of the Institute was to maintain contact with the membership. He brought up the subject of finances and informed the members that the budget had increased to $200,000 per year and that the income from dues was $150,000, leaving an apparent deficit of $50,000. Efforts were being made to economize. He declared that the continuation of the Institute's publication was a necessity. He called attention to the fact that a friend of the late Dr. James Douglas had placed a sum of money at the command of the Institute for the design and creation of a gold medal to be awarded each year for distinguished service in nonferrous metals.

L. W. Wallace discussed the work of the Federated American Engineering Societies. The most important work, in his opinion, undertaken by the Federation was in the espousal of the new patent bill. He brought up the subject of the revision of the mining laws, and expressed the opinion that, unless the mining men showed interest, the Arentz bill had no chance of passing.

Mining Methods at United Comstock Described

John R. Reigart was not present, and his paper on "Mining Methods at United Comstock Mines" was read by title. Mr. Reigart stated in his paper that three intermediate levels will be driven above the level of the principal adit, from 175 to 190 ft. apart. The upper haulage level is now being driven, and the ore above this will be the first to be mined. This intermediate is at the same level as the collar of the Yellow Jacket shaft. Three ore passes are being driven to connect the intermediate with the adit level. The ore passes are 9 by 8 ft. over all and divided into chute and manway compartments. The chute compartment is 4 ft. 6 in. x 6 ft. 4 in. in the clear, and is cribbed with wooden blocks between the 10x10-in. cribbing timbers.

The plan of the level comprises two

drifts, one on each side of the orebody. Crosscuts are turned off from the foot-wall drift every 55 ft. and connect with the hanging-wall drift. The ore passes connect with the foot-wall drift. A sublevel is being opened up above the intermediate level a vertical distance of 25 ft., and raises are driven to this sublevel. The raises are offset at the sublevel by the width of the raise and then continued to the surface on the south end of the orebody and to the hanging wall where possible on the north end. Grizzlies are placed in the raises at the sublevel. The southern part of the orebody will be mined by "milling" as long as the walls of the mill holes will stand. The north portion will be mined by a modified system of top slicing. The first top-slicing level will be started 25 ft. below the top of the ore, and the ore will be blocked out in pillars 25 ft. square. These are to be drilled and blasted, but only enough ore will be drawn to permit the working of the unmined pillars. While this work is going on, a second slice will be started 25 ft. below. This will give 50 ft. of broken ore up to the hanging. To protect against dilution by country rock, an endeavor will be made to maintain this bed of 50 ft. of broken ore approximately of constant thickness. The succeeding slice will be from 35 to 50 ft. in thickness, depending upon the conditions created by the work on the first two upper slices. The broken ore will be drawn in such a manner as to maintain the top of the ore at an even plane.

Charles A. Mitke was not present. His paper on "Metal Mine Ventilation in the Southwest" was read by title and discussion invited. At the suggestion of Jay A. Carpenter a short discussion on the behavior of oxygen apparatus in rescue work resulted in a brief mention of the Argonaut fire.

Augustus Locke presented a résumé of his work in developing prospecting methods. He described the investigations that were being undertaken by himself and associates upon the outcrops of copper orebodies. T. A. Rickard, Alfred Burch, J. C. Jones, and others entered the discussion of Mr. Locke's paper, which was the most interesting paper of the afternoon.

N. S. Greensfelder gave a synopsis of his paper on "Shot-Firing by Electricity." W. S. Weeks discussed the paper briefly.

F. F. Sharpless called attention to Earl C. Henry's paper on "Mining Methods in the Mineville (N. Y.) District." The interesting feature of the paper was the introduction of quantity units in place of costs.

Metallurgical Section Meets

The morning meeting of the metallurgical section was called to order by C. C. Brayton, but as none of those who had sent papers was present, the session, which was on iron and steel, was adjourned. C. W. Merrill presided at the afternoon session, which was devoted to milling. More than forty members and visitors were present. In the absence of A. J. Weinig, Mr. Merrill read his paper on "A General Study of United Comstock Metallurgy." The paper stated that the average ore occurring in the mines of the United Comstock Mines Co. at Gold Hill is oxidized and quartzose and contains a variable amount of clays and ochers, together with valuable sulphides and other minerals. It varies from hard to soft and has a high coefficient of grinding resistance. The settling and thickening properties are good after the ore has been washed free from soluble constituents, of which there is a high proportion. The gold exists in a free state alloyed with silver and copper. The silver associated with the quartz occurs as argentite and related compounds. Silver in insoluble form occurs principally in surface ores associated with manganiferous ochers. The content of soluble salts increases with depth. The treatment proposed consists of freeing the ore from woody material, of which there is a relatively large proportion, and washing out the soluble salts after coarse crushing to half-inch mesh. The slimes resulting from this treatment are thickened and the water-borne solubles are removed. They are then sent to leaf-type filters, where a loading of from 3 to 4 lb. of dry slime per square foot of filter surface can be obtained in from twenty-eight to thirty minutes. After washing, the cakes are transferred to stock mill solution and the retained moisture is displaced by cyanide solution. Owing to the high initial consumption of cyanide, a displacement of filtrate solution is obtained low in cyanide but high in value. This is precipitated and then run to waste. After displacement, the slime cakes are discharged, pumped to agitators for preliminary treatment and then combined with the slime resulting from the fine grinding of the ore discharged from the washers.

The washed coarse ore, after regrinding, is sent to bowl classifiers, the overflow from which constitutes the secondary slime, and the sand discharge is elevated and distributed to concentrators. The concentrate is ground finer in a ball-pebble mill and sent to the concentrate treatment plant. The sand tailings are laundered to sand leaching vats and the secondary slimes to the slime agitation plant. There are thus three important divisions in the solution treatment—the sands, the concentrates and the slimes. Except for the use of leaf-type filters and the washing operation, the process used follows in its principal features accepted cyanide practice.

L. D. Mills, in the absence of Walter L. Reid, read Mr. Reid's paper on the "Design and Construction of the United Comstock Mills." Mr. Reid described the preliminary ore tests and then the milling plant. The plant in question consists of three important features, the coarse crushing department, the fine grinding and concentrating, and the cyanide departments. In general reinforced concrete has been used for both the fine grinding and coarse crushing departments, and concrete foundations are used for the other structures. The cyanide plant is a steel-frame building. Throughout, the fire risk has been eliminated as far as practicable. Except for the tankage in the cyanide department, the roof sheathing and launders, the use of timber has been avoided. A machine shop, plate shop, warehouse, and assay and testing plant are provided, all of substantial construction. The total motor installation for the 2,000-ton milling and treatment plant is 2,800 horsepower.

Mr. Merrill invited discussion of Mr. Weinig's paper. Charles Butters, in reply, called attention to the fact that the meeting was being held in a hotel (the Palace Hotel) which had been built by money taken out of the Comstock mines and the members were discussing a paper which had to do with the rehabilitation of the wreck of a mine upon the Comstock. He stated that Virginia City was dead when he began his operation there twenty years ago, and now, he said, "a young man had the gall and nerve to spend more money than anyone had ever dreamed would have been spent upon this same Comstock." In his opinion there was justification for the enterprise.

Continuing, Mr. Butters brought up the subject of the presence of organic matter in ores and stated that large and unaccountable losses in recovery resulted from the presence of such matter. The nature of this organic matter influenced the losses. Unless, he said, tests have been conducted on a large scale, the plant operation might result in some disappointments. He pointed out the necessity for the determination of actual recoveries in the testing work and said that extractions calculated from assay differences did not give trustworthy information on actual recoveries. He advised his fellow members to get the gold rather than to resort to calculated recoveries. In his judgment the plant might be criticized from the viewpoint that it was too permanent. He said: "The metallurgical art is changing and permanent construction cannot be readily altered." He congratulated the young men who had planned and built the plant.

As a result of his experience, Mr. Merrill stated that ample oxidation secured by ploughing and harrowing would eliminate the difficulty caused by the presence of organic matter in some cases. Graphite, on account of its greater stability, causes greater difficulty. Where the organic matter consists of wood, in his judgment, ample facilities for oxidation being provided, the difficulty would be eliminated to a great extent. No further discussion being forthcoming, the chairman said: "We all are on record now as approving the methods that have been just described, and if anything goes wrong we are responsible."

Mr. Merrill, in the absence of Prof. Ernest A. Hersam, called for discussion of his paper, "Factors Controlling the Capacity of Rock Crushers." Theodore Simons then presented a brief

résumé of his paper on "Basic Principles of Gravity Concentration—A Mathematical Study." Professor Simons suggested that renewed attention should be given to fundamentals of wet concentration, stating that as one writer had put it "Flotation has settled down to the task of doing the things that it can do well, and older methods are coming up for reconsideration." In the discussion which followed Charles Butters suggested that, as metallurgists, it would be highly desirable to go back and study concentration with the idea of combining various processes in the treatment of ores. He said: "We must not consider ourselves to be cyanide experts, flotation experts, or concentration experts, but we must be metallurgists and consider the various specialties as all interrelated in the ore problem." He stated that the cyaniding of the easy ores had reached its limit in Mexico and the problem now presented had to do with the more difficult ores. As a consequence, cyaniding, concentration, flotation, and smelting were frequently necessary considerations in the treatment scheme of a given ore.

"Surface Tension and Adsorption Phenomena," a paper by A. F. Taggart and A. M. Gaudin, was read by title and discussion invited. O. C. Ralston said that the paper was a very good one as far as it went, and it went rather far, in his opinion. He called attention to the fact that the apparatus used by the authors for the measurement of surface tension had been described previously by A. W. Fahrenwald. He congratulated the the authors upon the excellence with which they had carried out the work.

"Charcoal Precipitation of Cyanide Solutions" was read by John Gross, co-author with Walter Scott. Mr. Gross said that the investigation had been suggested by A. W. Allen, and that, in the revision of Julian and Smart's book on cyaniding, Mr. Allen had given the correct explanation of the principle involved, thus anticipating the work of the investigators. The paper had to with fundamental investigation and was well received. Considerable interest was shown by the members present. Mr. Gross expressed the opinion that the commercial applicability of charcoal precipitation was doubtful. The limit of precipitation capacity was given by Mr. Gross as 2,000 oz. per ton of charcoal. The smaller the amount of cyanide present, the better precipitation seemed to work. On low-grade, weak cyanide solutions, there might be some field for its use. Mr. Butters expressed the opinion that charcoal might find application upon waste solutions and briefly discussed his own experience in introducing the Siemens-Halske process for the handling of such solutions. Mr. Crowe said that by the use of the Crowe process, solutions as low as 0.05 lb. of cyanide per ton had been successfully handled by means of zinc-dust precipitant. Relative to the use of charcoal, Mr. Gross said that various kinds had been used and little difference had been noted. Mr. Ralston expressed the opinion that the development of a special charcoal for the purpose was promising and might result in a greater precipitating capacity. Mr. Merrill stated that, in his opinion, the bulk and the interstitial openings were the important factors and that as a consequence it was likely that the precipitating capacity had been reached.

S. C. Lind discussed methods of applying the charcoal precipitant. Mr. Merrill suggested that further experiments should be carried out upon mill solutions. L. D. Mills pointed out the fact that zinc precipitation of weak solutions had been developed to the point where there was practically no lower limit to the cyanide or alkaline strength of solutions. He stated that the removal of oxygen from solutions had so changed the situation that there was no wash solution that could not be precipitated by zinc dust. In his opinion the field for charcoal precipitation was very narrow. In the evening the Institute members were delightfully entertained by F. W. Bradley at his home in San Francisco.

Hearst Memorial Mining Building, University of California, Berkeley

On Sept. 26, a party of fifty members left in the morning for the Hetch Hetchy operations of the City of San Francisco. The party was conducted by M. M. O'Shaughnessy, and the inspection trip was concluded on Sept. 29. Institute members who remained in San Francisco were entertained by automobile rides to points of interest. On Sept. 27, a visit was made to the University of California and on Sept. 28 a similar visit to Leland Stanford, Jr., University.

On Sept. 26, the members of the Institute met at dinner at the Engineers' Club, and an informal session followed. Albert Burch presided. E. P. Mathewson was the first speaker, and recited a bit of poetry which startled and convulsed everyone. Seeley W. Mudd, asked to discuss the requirements of modern prospecting, agreed with the opinion that scientific prospecting was necessary for the discovery of new mines; but, he said, the prospector should have, in addition to training in geology, a natural aptitude for the work. H. L. Slosson, Jr., presented a brief résumé of contrasts of present-day and past standards upon the Comstock. Milling costs in the seventies were, he said, $26 per ton and extraction was 65 per cent. In the latest operations at Gold Hill, mining and milling costs were estimated to be $2 to $3 and recoveries from 93 to 96 per cent were anticipated. D. M. Riordan then entertained the members with reminiscences of early Comstock history and his personal experiences.

Andrew C. Lawson was asked by the chairman to discuss the educational scheme necessary to train a modern prospector. Professor Lawson stated that the necessary requirement on the part of the educational institution was to make a good geologist. Continuing, he said that not every student will make a good geologist; the special talent required is possessed by few men, and only the man with special aptitude can be successful. Mark L. Requa and others made short addresses.

Lehigh Mining Engineers Have Successful Long Trip

On July 7 a party of thirty-six students of Lehigh University, with Professors Eckfeldt, Bartlett, and Fretz, left the university by automobile on an inspection trip to the principal mining districts of northeastern United States and Ontario, Canada. The first stop was made at Watkins Glen, and a fine opportunity given to study the geology of this region. The salt industry at Retsof, N. Y., was next visited. A short run then brought the party to Niagara Falls, where Canada was entered. Journeying north, the automobiles were left at North Bay, on Lake Nipissing, in charge of a few members of the party, while the rest took the train for Cobalt. At present there is no automobile road to the Cobalt district, but the government is working on one. Mining and milling of the silver ores at Cobalt were studied, and from Cobalt the train journey was continued to Timmins, in the Porcupine district.

Returning to North Bay, the journey was resumed by automobile westward to Sudbury and Copper Cliff, where the mines of the International Nickel Co. are situated. A stop was also made at the Worthington mine, further west. Nearing Sault Ste. Marie, the old Bruce

mines were passed en route, and at the "Soo" the power plant and the celebrated locks were inspected.

Marquette was next reached, and the largest charcoal iron blast furnace in the country, with its byproduct charcoal plant (Pioneer Iron Co.), proved worthy of study. One of the newest steel-concrete ore docks was also inspected. The mines of the Cleveland-Cliffs Iron Co., at Negaunee and Ishpeming, were the next objects of note.

Aside from the educational advantages of the tour, it offered a wonderful opportunity for healthful camping life. The party traveled in six automobiles, with a speed truck to carry the baggage, and were provided with tents and cots as well as cooking equipment, and prepared their own meals. Stops were made at numerous points of interest en route other than those already mentioned.

Mining and Metallurgical Society Elects Officers

The New York Section of the Mining and Metallurgical Society of America held a meeting Wednesday evening, Sept. 27, at the Harvard Club, New York City. This was the first meeting of the business year of the society, and new officers for the section were elected. These were: Chairman, C. M. Weld; vice-chairman, Herbert G. Moulton; and secretary-treasurer, Louis D. Huntoon. After the dinner F. A. Eustis spoke on the subject of electrolytic iron, its preparation, commercial application, the cost of manufacture, and its future. The discussion aroused much interest.

The Joseph A. Holmes Safety Association Directory

A revised list of the various chapters of the Joseph A. Holmes Safety Association, together with the names and addresses of each secretary, is as follows:

Butte Safety Chapter, Clyde DeWitt, Butte, Mont.; Newcastle chapter, J. P. Jones, Newcastle, Ala.; Dante No. 1 chapter (white), R. L. Ray, Dante, Va.; Dante No. 2 chapter (colored), T. W. Walthall, Dante, Va.; Wilder No. 1 chapter, Coleman Smith, Wilder, Va.; Empire Mines chapter, H. Crouch, Grass Valley, Calif.; Leona Mines chapter, W. H. Shell, Leona Mines, Lee County, Va.; Cokedale chapter, Charles Smith, Cokedale, Colo.; South Fork chapter, James Graham, South Fork, Pa.; Desloge Consolidated Lead Co. chapter, H. J. Schiermeyer, Desloge, Mo.; Lilly-Cassandra chapter, Charles Lees, Lilly, Pa.; Frugality chapter, Charles L. Simmers, Frugality, Pa.; Fallen Timber chapter, William T. Lamb, Fallen Timber, Pa.; Blandburg chapter, Jerry Hanagan, Blandburg, Pa.; Coalport chapter, J. Frank Taylor, Coalport, Pa.; Pierce Florida chapter, H. E. Collins, Pierce, Fla.; Madera chapter, Robert Moore, Madera Clearfield County Pa.; Smoke Run chapter, George Finch, Smoke Run, Pa.; Mark Simmons chapter, Mae Sughrue, Munson, Pa.

MEN YOU SHOULD KNOW ABOUT

Fred Pope, of New York, has been visiting Kirkland and Porcupine, Ontario.

Rex Taylor has been investigating arsenical ores near Tamagami, Ontario.

Charles Bocking, manager of Butte & Superior Mining Co., is in San Francisco.

F. G. Huycke, consulting engineer of Big Dyke Gold Mines, Ltd., has sailed for England on a business trip.

W. H. Blackburn, general manager of the Tonopah Mining Co., has returned to Tonopah from coast points.

James H. McClintock has accepted the Republican nomination to the office of United States Senator from Arizona.

Robert Stanley, president of the International Nickel Co., sailed on Sept. 25 for a month in Europe on business.

R. H. Sargent, A. A. Baker, and **J. B. Mertie, Jr.**, of the U. S. Geological Survey, have returned after the season's field work in Alaska.

John J. Daly, pioneer mining man of Utah, now a resident of Los Angeles, has been in Salt Lake City with Mrs. Daly visiting his sons.

O. B. Perry, general manager of the Yukon Gold Co., is in San Francisco, having recently returned from Ipoh, Federated Malay States.

James Rose, consulting mining engineer of Hibbing, Minn., has left for Texas to examine a silver mine in the southern part of the state.

S. B. Stone, of the staff of the U. S. Bureau of Mines, will have charge of the press relations division of the federal fuel distributor's organization.

Clyde Heller and Frederic Bradshaw, president and general manager, respectively, of the Tonopah Belmont Development Co., have been in Tonopah.

C. J. Stover, of Philadelphia, has been appointed manager of the Consolidated Asbestos Corporation in place of **John Carson**, who will resign on account of ill health.

Sherwood Aldrich, president, and **J. R. Dillon**, secretary of the Ray Consolidated Copper Co., were recent visitors at the plant of the Mesabi Iron Co. at Babbitt, Minn.

H. R. Plate has returned from a two months' trip to Alaska, where he examined mining properties for Chicago clients in the Willow Creek district and southeastern Alaska.

Prof. H. E. T. Haultain, of the University of Toronto, has been visiting northern Ontario mining camps, where he showed motion pictures of the action of balls in a tube mill.

Charles C. Camsell, Canadian Deputy Minister of Mines, has returned to Ottawa from a visit to England and the Continent. He represented Canada at the International Geological Congress in Brussels.

A. D. Niles, formerly of the International Nickel Co., in connection with English interests has taken over under option thirteen claims of the Telluride Co. in the Skead Township gold area of northern Ontario.

Walter J. Eaton, who recently resigned as mine superintendent of the Smuggler-Union Mining Co., at Telluride, Colo., to return to Mexico, is at Parral, Chihuahua, with the San Francisco Mines of Mexico, Ltd.

H. W. Walter, formerly assistant general superintendent of the International Nickel Co's Oxford Works, at Bayonne, N. J., has been made assistant general manager of the same company at the Port Colborne, Ontario, plant.

H. Ami, Canadian geologist, has returned from abroad after an absence of eighteen months, during which he was investigating the situation as regards iron, petroleum, and coal. He was elected one of the vice-presidents of the International Geological Congress.

Bulkeley Wells and Fred G. Farish, president and general manager, respectively, of the Metals Exploration Co., of which the United Comstock Mines Co. is a subsidiary, are in Virginia City during the preliminary tryout of the new 2,500-ton mill of the latter company.

Frederico Giolitti, Italian metallurgist, was the guest of honor at a luncheon given on Sept. 26, by the Iron and Steel Committee of the A.I. M.E. at the clubrooms of the Federated American Engineers' Society, New York City. Mr. Giolitti is head of the Ansalmo Works of Turin, Italy, and son of the former Prime Minister of Italy.

Mining and metallurgical engineers visiting New York City last week included: **W. M. Dake**, of Denver, Colo., **D. J. Parker**, of Pittsburgh, Pa., **J. H. Means**, of Washington, D. C.; **T. Lindsley**, of Peterboro, N. H.; and **H. V. Winchell**, of Los Angeles, Calif.

OBITUARY

August Knecht, editor of the *Miners' Daily Journal*, died on Sept. 25, at Pottsville, Pa.

Charles Davis Healy died at Johannesburg, South Africa, on Aug. 18. Mr. Healy had been general manager in South Africa of the Standard Oil Co. of New York for thirteen years.

Walter T. Witherbee, an iron-ore producer, died on Sept. 28, at his home near Port Henry, N. Y. He was sixty-two years old, and was the son of the late Charles H. Witherbee, founder of the Witherbee, Sherman Co.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

THE United Comstock Mines Co., headed by Bulkeley Wells, has started the first unit of its new 2,000-ton mill at Virginia City, Nev. The project is notable as an attempt to treat low-grade ore from the old Comstock mines. Efficient mining and milling are depended upon to make the enterprise financially successful.

The Chief Consolidated Mining Co. has acquired the Gemini and other mines at Eureka, Utah.

Sailors strike on Lake Superior boats. Ore shipments are curtailed.

The Granby Consolidated company has bonded the George group of claims, in the Portland Canal district of British Columbia.

The Chestatee Corporation gets $469,784. Remainder of appropiated fund for war minerals relief is $3,395,380.

High-graders are said to have confessed to stealing thousands of dollars' worth of precipitate from Kirkland Lake mill, in northern Ontario. Operations are reported to have extended over two years.

The Alaska-Juneau company is milling 6,000 tons of ore daily at a profit.

Developed western fluorspar deposits can contribute little to eastern market, says Bureau of Mines report.

The first shipment of bullion from the New White Caps mill, at Manhattan, Nev., indicates successful plant.

Chief Consolidated Acquires New Property in Utah

Gemini and Ridge & Valley Will Be Operated Under Fitch Management —Deep Mining Planned

The Chief Consolidated Mining Co., operating at Eureka, Utah, has acquired the Gemini, Ridge & Valley, and Eureka mines. Work will be started immediately in the Gemini, and later in the Ridge & Valley and Eureka mines, when a thorough examination into conditions has been made. The Gemini, which has paid $3,000,000 in dividends, has been little developed below the water level. The new management will undertake deep mining on lines similar to those which have been so successful in the Chief. Operations will be carried on under the leasing system, in force at the Chief and Grand Central mines. The operating staff consists of Cecil Fitch, manager, and J. Fred. Johnson, general superintendent.

New pumping equipment has been ordered. For the present the steam plant will continue in use, to be replaced later by electrical equipment when conditions warrant, and when it is possible that the adjoining Ridge & Valley and Eureka mines may be worked with the Gemini through one shaft.

Mount Lyell Co. May Shut Down

By Cable from Reuters to "Engineering and Mining Journal-Press"

Melbourne, Sept. 28—The Mount Lyell Mining Co. has given its employees a week's notice in consequence of the refusal of the engineers to work forty-eight hours a week. Unless some settlement is reached in the meantime complete cessation of production will result.

United Comstock Turns Over Machinery in New Virginia City Mill

The first unit of the milling plant of the United Comstock Mines Co., at Virginia City, Nev., with an ultimate capacity of 2,000 tons of ore per day, was started on Sept. 20 to give the mill machinery a preliminary tryout. On the 23 the official start was made, and within two or three weeks the plant will be treating at the rate of 60,000 tons per month. Mill construction was started late in July, 1921. The expectation is to treat low-grade ore from mines that were operated years ago. Economical mining and milling are anticipated.

Rawley Mine, in Colorado, Will Be Worked—A. S. & R. and Metals Exploration Participate

The Colorado Corporation is the name of the new company which has taken over the Rawley mine in Saguache County, Colo. Lewis Sanders is president of the company, Bulkeley Wells chairman of the board of directors, and George A. Stahl secretary-treasurer. The company is financed jointly by the former owners, the American Smelting & Refining Co. and the Metals Exploration Co.

Work has started on the building of a seven-mile tramway from the mines to a 500-ton concentrating mill to be constructed at Shirley, on the Denver & Rio Grande road. The property is developed by a tunnel, which cuts the mines at about 1,000 ft., with a raise to the surface. Many thousand tons of ore are blocked out on the various levels. The values are chiefly in lead and silver.

Confesses High-Grading in Kirkland Lake Mill

Thefts of Gold Precipitate Extend Over Two Years—Samples Diluted to Make Recovery Check

Five men have been arrested in connection with the theft of cyanide precipitate from the Kirkland Lake Gold Mines. It is difficult to determine what amount was actually stolen, but Beswick, solution man in the Kirkland Gold mill, is reported to have admitted receiving approximately $20,000 and is said to have made restitution to the extent of $13,000. If Beswick received $20,000 for his share, the total amount stolen must have been greatly in excess of this. Beswick, in addition to being solution man in the mill, also had charge of melting the precipitates into bullion.

In taking the daily samples for solution assays these samples were diluted a calculated percentage. Accurate records of these were kept, and a corresponding amount was taken from the precipitates. By this method there was little chance for detection, and the low values obtained from the ore were ascribed to dilution in the mine from waste rock. The Kirkland Gold has had a hard struggle since it started milling, and as Beswick is said to admit having carried on stealing of precipitates for the last twenty months, the amount stolen represented the difference between profit and loss for the property. Some of the men involved were well known, and it is believed that further arrests will be made in the near future.

The old adage that a criminal always makes one mistake in the perpetration of his misdeeds is well exemplified in the solving of the mystery surrounding

the disappearance of the gold brick stolen from the McIntyre about ten months ago. One of the men concerned in the theft was under suspicion for some time. Detectives had him watched, but finally decided that he was innocent, and this man, an Italian, then returned to his home in Italy. A woman in the same town in which he was living in Italy wrote to her sister, whose husband was employed at the McIntyre, stating that this man had gone to Ontario to work in the McIntyre mine, and though he was worth nothing when he left he now was living as a real "signor." This letter came to the attention of the McIntyre officials and led to the arrest of two Italians in Porcupine and an Italian in Italy. The brick had been sawn in four parts and one of these parts was found in Porcupine, where it had been buried in the ground.

Sulphuric Acid May Serve to Neutralize Alkalinity in Arizona Desert

The Calumet & Arizona Mining Co. may secure an added market for its sulphuric acid, in the agricultural industry. The company has made donation of 100 tons of acid to the farmers of the Casa Grande valley, where experiments are to be made toward the correction of alkalinity in ten special plots of ten acres each. Chemists and soil experts from the University of Arizona will direct the application of the acid and supervise the subsequent irrigation and cropping. Some believe not only that land can be reclaimed from present worthlessness, but that the acid treatment, on large areas, may serve toward the betterment of crops to such an extent that profit will attend the use of acid as fertilizer. The company now is furnishing acid for the leaching tanks of the New Cornelia company, its subsidiary at Ajo, but within a few years New Cornelia will turn gradually to its sulphides, and only a small proportion of the present acid supply will be needed. The local works are furnishing high-percentage acid to the works of the Apache Powder Co., near Benson, and other consumers are being supplied, though in small quantity.

Mandy Mine, in Manitoba, May Be Reopened

G. R. Bancroft, Canadian representative of the Tonopah Mining Co., of which the Mandy Mining Co. is a subsidiary, states investigations are being made into the treatment of complex copper ores which may result in the resumption of operations at the Mandy mine, in northern Manitoba. The mine was closed down in 1921 because of the high cost of transporting ore of the grade left in the mine. Up to that time the company had produced about $3,000,000 worth of copper. With the advance in the price of copper there is a tendency to greater activity in copper properties, and if transportation difficulties can be overcome the Mandy may be again operated at a profit.

Stockpile of Zinc Concentrate "Grows" $300,000 in Six Months

It is estimated the Commerce Mining & Royalty Co. has "realized" approximately $300,000 since last March by virtue of the rise in prices of zinc ore. At the present time the company has about 23,000 tons of zinc concentrates stocked at its Webber mine, just north of Picher, Okla. In addition, it has several thousand tons stored in bins at its other mines. The storage at the Webber, however, has been for more than a year, and it is believed that the company had at least 20,000 tons there last March, when the price of zinc ore was $25 a ton. Zinc ore is now selling for $15 a ton more than this, which makes the ore worth $300,000 more than last March. It is certain the company has more than a million dollars' worth of zinc ore stored at its different properties. The company is strong financially, however, and the district is assured that the ore will not be disposed of in such a way as to weaken the market. J. F. Robinson and George W. Coleman, of Miami, are principals in the Commerce company. About fifteen years ago they were drillmen in the field.

Sailors on Lake Superior Boats Strike Following Industrial Recovery From Railroad Tie-up

The railroad situation, which has had a marked effect on iron-ore shipments from the iron ranges of the Lake Superior district, owing to the scarcity of cars, is gradually assuming normal. To offset this betterment, and on the heels of the settlement of the railroad strike, comes the announcement of a strike by the sailors on the boats of the Great Lakes, effective Oct. 1. At this time of the year it is unfortunate for the iron-ore operators that a strike should be called, as many of the companies are rushing operations to fulfill their schedules for the year. It will also interfere with the attempt to avoid a coal shortage during the winter. Should the strike become generally effective against the big fleet of the Lake Carriers' Association, it would produce a large curtailment of iron-ore shipments. However, there is on hand at the lower Lake furnaces and docks approximately 37,000,000 tons of ore, which would take care of all normal demands during the winter months.

Black Eagle Acquires U. S. Smelting Property Near Picher, Okla.

The Black Eagle Mining Co., of Picher, Okla., has purchased the mill and lease of the U. S. Smelting & Refining Co., two miles northwest of Treece, Kan., and about three miles northwest of Picher. The consideration is reported at about $150,000. The mill, which is one of the large and modern concentrators of the district, was erected in the fall of 1917, and for several years the property was a steady producer. The lease comprises 160 acres, and there are two shafts near the mill and one about a quarter of a mile to the west, connected with it by surface railroad. M. F. Owens, of Miami, is general manager for the Black Eagle company, and W. M. Garred will act as superintendent for the U. S. property, which is to be started up as soon as necessary repairs can be made at the mill.

G. W. Parrish Mining Co. Adds to Its Plant at Picher, Okla.

The G. W. Parrish Mining Co. has taken over the mine originally known as the Tampa, situated in Kansas just northwest of Picher, Okla. The mill is being repaired, an improved sludge department installed, and a new tramway being built. It is expected that the plant will start operation in October.

Black Lake Asbestos Mine Involved in Litigation

The Bondholders' Committee, representing a majority of the holders of bonds of the Black Lake Asbestos Co., at Black Lake, Quebec, is preparing to take action against the directorate for possession of the property. The proceeding will be taken in the Quebec courts, as the head office was removed from Toronto in 1921, when the J. A. Jacobs interest acquired control. Since then no interest has been paid on the bonds.

Granby Company Bonds George Group in Portland Canal District of British Columbia

What is considered in the Portland Canal district of British Columbia to be the most important mining transaction since the Guggenheims bought a controlling interest in the Premier mine, is the bonding of the George group of twenty claims, at the head of the Bear River valley, by the Granby Consolidated M. S. & P. Co. The property has been held for a number of years, and a large amount of surface stripping and trenching has been done. A 50-ft. belt, containing about 10 ft. of quartz that is said to assay $4 per ton in gold and 3 per cent of copper, has been traced for 1,000 ft. up the mountain-side, and a 4 to 5 ft. vein, assaying 8 to 14 per cent copper, with low gold values, has been traced for 2,000 ft. A little work has been done on a third vein, about 3 ft. wide, which is said to assay 16 per cent copper. It is too late in the season for much work to be done this year. The George group is about six miles from the end of the Portland Canal Short Line railway. This line was repaired and put into operating condition two years ago, but subsequently every bridge was washed out by a heavy flood, and no repairs have been made since.

Callahan Zinc-Lead Co. Resumes in Coeur d'Alene

Operation of the mine and concentrator of the Callahan Zinc-Lead Co., at Interstate, in the Coeur d'Alene district of Idaho, will be resumed at once. A factor of considerable importance in future operations is the recent reduction in freight rates to eastern points. Freight costs on zinc output have been reduced from $18.50 to $13.50 per ton, with a corresponding reduction from $13 to $10 on lead. On a basis of average monthly shipments of 2,400 tons of zinc concentrate, and 1,200 tons of lead concentrate, the yearly saving will approximate $187,000.

Transvaal Mining Back to Normal

By Cable from Reuters to "Engineering and Mining Journal-Press"

Johannesburg, Sept. 29.—At the quarterly meeting of the Chamber of Mines, Sir Evelyn Wallers, reviewing the mining position, said that in the last three months the industry had settled down to hard efficient work, and that the scale of operation at the gold mines was now approximately the same as before the strike.

Standard Chemical Co. Produces 100,000 Lb. of Vanadium Monthly

John I. Mullin, general manager of the Standard Chemical Co. of Naturita, Colo., states that his company, handled more than $18,000,000 worth of vanadium and radium produced from ores mined in Colorado during 1921. Mr. Mullin says that his company is now producing approximately 100,000 lb. of vanadium monthly. The company is employing 125 men, and expects to work a much larger force with the return of normal conditions.

Western Fluorspar Deposits Thus Far Developed Are Small

The importance of fluorspar in the steel and ceramic industries is so great, and accurate information on methods of mining, milling and utilization, and on cost of production and possibilities of future production is so lacking, that it has been considered advisable by the Bureau of Mines to investigate all phases of the fluorspar industry in the United States. At the request of, and in company with, several eastern fluorspar producers, examination has been made by R. B. Ladoo, of the principal fluorspar deposits of the western states. This examination was followed by an intensive study of the producing mines in Illinois and Kentucky. It was found that most of the deposits in the far western states were small and could not be relied on to produce much surplus over the needs of the western states. Costs of production in the Illinois-Kentucky field have increased, owing to the increasing depth of the principal mines, the large amount of water that must be pumped, and the increased costs of labor and supplies.

News from Washington

By PAUL WOOTON
Special Correspondent

Government Financing Would Assist Marketing of Silver

H. N. Lawrie Sees Advantages in Extending Credit to American Producers Under Federal Farm Loan System—High Exchange Value of Silver Will Help Farmers—Miners Deserve Aid

THE extension of the Federal Farm Loan system to include producers of silver probably will be urged by the American Gold and Silver Institute before the next meeting of the Congressional Committee on Banking and Currency. The arguments in favor of the plan are given in a recent letter by H. N. Lawrie, managing director of the Institute, to Congressman McFadden. Excerpts from his letter follow:

"An estimate made by the Institute indicates that the 208,000,000 oz. of silver which was sold to Great Britain for delivery in India during the war period will have been replaced by the Mint through the purchase of domestically produced silver by about November, 1923. When these purchases by the Mint expire, the domestic production of new silver will be forced to compete in the international market. Though the international price of silver has been recently in the neighborhood of 70c. per ounce, it is quite evident that when our annual production, in excess of 50,000,000 oz., is thrown upon the market it will have a depressing effect upon the price.

"Producers of silver are now giving consideration to the organization of an American silver export association to provide for an order y marketing of their product when open-market conditions again prevail. They are now forced to almost immediately liquidate their product in order to meet their operating costs. Under such a system the buyer of silver has every advantage in regulating the price.

"It is estimated that 90 per cent of the silver production of the world is controlled by American capital invested largely in the United States, Canada, Mexico, and South America. The chief buyers of silver are in Europe and in the Orient, where practically no silver is produced. The buyers substantially dictate the exchange value of silver by manipulation. The buying season in the Orient is most active between September and May, and during the remainder of the year the market is less active. Although the monthly production of silver is fairly uniform, the marketing conditions are as seasonal as those governing the marketing of wheat.

"The extension of credit by the War Finance Corporation to wheat growers provided, at a critical moment, the means for a more orderly marketing of that product, and I understand that it is now proposed, in a bill before the Banking and Currency Committee, to expand the credit facilities of the Federal Farm Loan system to include the extension of credit, based upon agricultural products, at low government rates of interest. The silver producer is more dependent upon the foreign market than the wheat grower, and he should be accorded the same preferred credit facilities by the government for the marketing of silver as the producer of agricultural products. Upon the low cost of government credit extended the producer of silver depends the success of any organized effort to stabilize the exchange value of silver at a satisfactory level.

"There is a shortage of newly produced silver to satisfy normal demands, while in the case of some agricultural products there frequently occurs an overproduction and a keen competition with growers in foreign countries. For these reasons silver is a commodity which should be regarded as a preferred credit risk, upon which the extension of government credit on even more favorable terms than those proposed for agricultural products may properly be based.

"It should also be pointed out that a low exchange value for silver means a low Indian and Chinese purchasing power in our market. The English manufacturer of cotton, for instance, cannot sell as much goods to India and China when the exchange value of silver is low as when it is high, and, consequently, cotton growers of this country cannot sell as much raw cotton to English manufacturers. When the exchange value of silver is low it enables all countries to purchase at less cost the wheat grown in India, thereby reducing the demand for and price of our wheat.

"In brief, the exchange value of silver occupies a most important and intimate relationship to the successful marketing of American agricultural and other products, so the extension of the credit facilities of the Federal Farm Loan system to the silver producer, resulting in a more stable and a higher exchange value for silver, will insure a better market for agricultural products, which apparently is the main object of your bill."

Pittman Act Silver

Purchases of silver by the Bureau of the Mint during the week ended Sept. 30 amounted to 744,000 oz. This brings the total purchases under the Pittman Act to 132,905 951 oz.

Manganese Ore from Brazil

Following the acquisition by the Tennessee Coal, Iron & R.R. Co. of its Brazilian manganese mines, 40,000 tons of ore has been received by the company from Brazil via the Port of Mobile and the Mississippi-Warrior Rivers Barge Line.

Chestatee Company Is Paid $469,784 on New War Minerals Award

The Secretary of the Interior has approved in its entirety the recommendation made by the War Minerals Relief Commission in the claim of the Chestatee Pyrites & Chemical Co., and the $469,784.62 has been paid to the claimants. Secretary Fall denied their request that they be allowed interest on certain of the sums involved in the settlement.

The payment of so large an amount to the Chestatee company, together with the payment of a large number of smaller claims recently, has materially reduced the balance of the appropriation available for the payment of claims. The balance as of Sept. 30 was $3,395,380.34.

An additional award of $13,850.01 has been recommended by the War Minerals Relief Commissioner in the claim of E. C. McComb, of Batesville, Ark. The former commission recommended payment in this claim of $10,328.01. This amount was increased to $12,521.30 by the Secretary of the Interior. The additional award now recommended consists almost entirely of the amount allowed for ore, which had not been accepted by the former commission. Other recent recommendations are as follows:

Altshuler and Berger, San Francisco, $4,482.34; Auburn Chrome Mines, Menlo Park, Calif., $8,457.92; Kalkins & Patterson, Yreka, Calif., $795; Veatch & Sullivan, Callahan, Calif., $1,299; Baker, Rostetter & Fippin, Callahan, Calif., $1,038.75; Williams & Facey, Callahan, Calif., $731.50; James Richey & Sons, Waldo, Ore., $273.33; Phillip Weissman, Lindsay, Calif., $1,584; Williams & Chapman, Carriville, Calif., $728.90; T. G. Hersum, Eureka, Calif., $500; Phil. Stephens, Crescent City, Calif., $244. The claims of William Dawkins and G. H. Rogers were disallowed on the ground that they did not come within the act.

A question having arisen in connection with the recommendation of an award of $7,585.43 additional in the claim of the Eureka Mining Co., Cushman, Ark., a re-examination of the papers has been made and the former recommendation affirmed in all particulars. In that recommendation, it was found that stimulation could be dated properly from March 22, 1918, when one of the partners in the enterprise attended a meeting called by the War Industries Board. An additional allowance of $4,766.53 for equipment was approved.

Under the amended act, the stimulation period of the Chrome Mining Co. was lengthened, for which $2,650.72 was allowed. The company maintained a Philadelphia office, for which $1,545.07 was allowed for upkeep and sundry incidental expenses.

The claim of William Dawkins, of Eureka, Calif., was disallowed on the ground that it does not come within the provisions of the act.

New Jersey Leads States in Smelting and Refining

The country's 111 smelting and refining establishments produced materials having a total value of $972,093,552, according to a report just made public by the Bureau of the Census covering the industry in 1919. Thirty-one per cent of the establishments were engaged in copper smelting and refining; 22 per cent handled lead; 35 per cent handled zinc, and 12 per cent all other metals. These smelting establishments used $543,341,935 in capital and employed 44,271 persons in and about their plants.

More than one-fourth of the smelting operations of the country are conducted within the boundaries of the State of New Jersey. Arizona has smelting plants whose output is practically 10 per cent of the country's total. Pennsylvania accounts for 4.4 per cent and Illinois 4 per cent. Colorado's smelters contribute 1.9 per cent of the country's output of smelted products, the figures show.

The great growth of the smelting industry of this country is shown by the figures of output in the following years: 1899, $358,786,472; 1904, $451,398,354; 1909, $580,417,518; 1914, $669,138,943. These totals compare with $952,019,048, which represents the value of the products of copper, lead and zinc smelting and refining in 1919. In 1919, thirty-four plants were engaged in copper refining; twenty-five in lead refining, and thirty-nine in zinc.

Mines Products Constitute Half of Railroad Tonnage

Despite the fact that there was decrease of 18 per cent in the tonnage of mine products carried by the Class 1 railroads during the second quarter of the current year, as compared with the corresponding quarter of 1921, mines furnished nearly one-half of the total freight tonnage carried during the second quarter of 1922. According to figures just compiled by the Interstate Commerce Commission, the mines of the country contributed 101,404,725 tons of freight to the Class 1 carriers during the second quarter of this year. The tonnage of the other commodity classes is as follows: Products of agriculture, 19,965,391 tons; animals and their products, 6,150,416 tons; products of forests, 22,779,953 tons; manufactured and miscellaneous products, 57,258,094 tons; merchandise, 11,036,921 tons. The detailed figures covering the movement of mine products, during the second quarter of this year are as follows:

Commodity	Tons Carried
Anthracite coal	2,751,994
Bituminous coal	50,006,612
Coke	3,239,701
Iron ore	11,812,056
Other ores and concentrates	2,041,171
Base bullion and matte	113,415
Clay, gravel, sand and stone	27,526,527
Crude petroleum	1,490,317
Asphalt	490,251
Salt	767,089
Other products of mines	1,165,592

News by Mining Districts

LONDON LETTER

"Perfect" Concentrate Made by Otavi Company in Southwest Africa—Plans for Merger of Mexican Mines

BY W. A. DOMAN

London, Sept. 22—It is seldom that one reads in the report of a mining company that technically faultless exportable "ores" were produced, but this statement is made by the management committee of the Otavi Mines & Ry. Co., working in Southwest Africa. This technically faultless exportable material was produced in the new concentration works from the poorer ores of the main body and the hanging leader. The output for the twelve months from April 1, 1921, to March 31, 1922, was 85,000 tons. The cost of extraction varied between 5.37s. and 9.55s. per ton, and the total cost per ton of ore output was 12.89s.

Presumably an eight-hour day is not a hard and fast rule at Tsumeb, for the premium system of winning ore has been introduced and has proved a success. During the war years, when the company in various ways was limited in its activities, development was kept well in hand. In the balance sheet is an item "Developed Ore, £195,000," this being 7s. 9d. per ton on upward of 500,000 tons so opened up.

Last year the smelter worked most of the period and latterly with both furnaces. From 24,000 tons of ore averaging 6.5 per cent copper and 8.4 per cent lead, 2,894 tons of copper matte, averaging 49.3 per cent copper, 20.3 per cent lead, and 850 g. silver per ton, in addition to 450 tons of metallic lead averaging 97.3 per cent lead and 1,628 g. silver per ton, were produced. A dividend of 5 per cent is declared, and £61,000 is written off for various buildings and works. Financially the company is well managed, and various items, one of them being the smelter, appear in the balance sheet at the nominal value of £1.

The Consolidated Gold Fields of South Africa, which has already substantial American interests, is endeavoring to arrange a big merger of Mexican mines—fifteen groups, to be exact. Options are already secured over the properties of the Compania Metalurgica Mexicana; Compania Minera Nazareno y Catasillas, S. A.; and Compania Minera "La Constancia" S. A. Desiring to include the Mazapil Copper Co., its directors were approached with an offer of 35s. per Mazapil share, payable in 7 per cent cumulative first-preferred shares of the new company to be formed. A majority of the board rejected the offer, but the minority and their associates, representing over 200,000 shares out of 600,-

000 issued, are prepared to accept. The purchase price is payable in either of two ways, (a) 5s. cash and $6.75 (i. e., 30s.) in the first-preferred shares; or (b) $7.87 (i. e., 35s.) in the first-preferred shares. For some years there has been no free market in Mazapils, and it is intended to list the new shares on the London, Manchester and New York exchanges. The new company will be registered in the State of New York with capital thus: First-preferred 7 per cent cumulative stock, $7,500,000 in $5 shares; second-preferred 7 per cent cumulative stock, $7,500,000 in $100 shares; common stock, 250,000 shares, of no par value.

The second-preference stock will be allotted to the three companies above mentioned as purchase consideration; the 250,000 shares of common stock will be used for underwriting, commissions and other charges, and of the first-preferred stock the Gold Fields will undertake to obtain subscriptions for $2,775,000 in cash for working capital and such additional amount as will provide 5s. per share to the Mazapil holders, and the remaining shares will be issued in exchange for Mazapil shares.

The Mazapil company was formed in 1896. In 1912 it paid a dividend of 30 per cent and bonus of 50 per cent; 1913-1916, nil; 1017, 5 per cent; 1918, 7½ per cent; 1919, 22½ per cent and bonus of 20 per cent; and again in 1920 the dividends were nil.

INDIA

New Mining Legislation Proposed

In the Legislative Assembly in India, C. A. Innes, Industries member of the Executive Council, has introduced a bill amending the Mines Act, according to Reuters. The principal amendments define the respective functions of the central and local governments, and propose the modification of the definition of a mine so as to include excavations for minerals regardless of depth. The raising of the age of children employed in mines from twelve to thirteen, and the prohibiting of the presence or employment of children underground, is proposed. The amendments also restrict the hours of labor to sixty hours per week for workers above ground, and fifty-four per week for workers below ground, and prescribe a weekly day of rest. The penalties are also increased for disobedience of orders, resulting in death or serious injury to workers. Mr. Innes, in introducing the bill, admitted that it was a difficult and contentious matter, but stated that it was in accordance with international obligations.

War Minerals Awards

Among the recommendations made recently by the War Minerals Relief Commission are the following: Chrome Mining Co., Philadelphia, $4,195.79; Henry Schirmeier, Michigan Bluff, Calif., $360; T. G. Hersum, Eureka, Calif., $500.

JOHANNESBURG LETTER

De Beers Consolidated Fights Payment of Income Tax on Diamond Operations

BY JOHN WATSON

Johannesburg, Aug. 22.—In the Rand Division of the Supreme Court on Aug. 18, an income-tax case, in which De Beers Consolidated Mines, Ltd., appealed against the Commissioner of Inland Revenue, was heard by Justice Gregorowski. In May, 1919, the sale of diamonds by the Diamond Syndicate in England began to fall off, owing to world conditions, and by June, 30, 1920, the market for diamonds had practically ceased to exist. Evidence showed that the De Beers Company had stocks of diamonds on hand, as follows: June 30, 1919, 441,028 carats; June 30, 1920, 753,951 carats.

Expert evidence was given on behalf of the appellant company, showing that in normal years the world purchases diamonds to the value of £12,000,000 per annum. Saul Solomon, in his address for the respondent, pleaded that the company could not say that diamonds were unsalable unless it reduced the price and thus tested the position. There were tens of thousands of retailers throughout the world who would have seized the opportunity of getting stones at a reduced value and making a large profit. Judgment was reserved.

A 33½ carat diamond found at Blesbok has been sold, recently, for £800.

A conference between employers and trades-union representatives was held at the New Law Courts in this city on Aug. 14 and following days. This conference was called by the Mining Industry Board, with a view to forming a conciliation committee, to settle disputes in the future and thus avert disastrous strikes. The proceedings are being conducted privately, press reporters not being admitted. The work of the conference is said to be going ahead smoothly.

The report of the White Labor Department for July was cheerless to a degree. Of 1,421 white men who applied for work in Johannesburg, employment was found for only 353 (including 273 sent to relief work). The number of underground workers still out of employment is greater than can be absorbed. Employment in the building trade is somewhat better; many new houses are going up and alterations are being effected in town and suburbs.

The party of engineers sent by the Railway Administration to investigate the northern coast of Zuzuland has now returned to Johannesburg. It is proposed to form a new harbor for the shipment of coal from the Vryheid district. The choice will be between Kosi Bay, Sordwana Bay, or Lake Sibaya. The Administration has engaged George Buchanan, of the firm of C. S. Meik & Buchanan, of London, to report. He has arrived in South Africa. He was chairman and chief engineer of the Rangoon Port Trust for fourteen years.

Business on the Stock Exchange here during the past week has been very active. London sent orders for such shares as East Rands. In medium-priced shares, Randfontein Estates were the great feature, and tens of thousands of shares changed hands daily. The price rose from 23s. 6d. to 26s. 9d., but fell back to 24s. 9d. on receipt of London cables concerning Germany and Ireland.

ONTARIO

South Lorrain Properties Attract Attention

Cobalt—The McKinley, which resumed operations about two months ago, is now producing at the rate of approximately 45,000 oz. monthly, largely from mill rock, and it is understood that the company is realizing a fair profit.

The Mining Corporation is considering the haulage of ore from the Frontier property, in South Lorrain, which it has under option, to the company's mill in Cobalt. It is believed that tractors can haul the ore for twenty miles at a low enough rate to do away with the necessity for a mill in South Lorrain.

Recent developments in South Lorrain have been extremely favorable, and a good deal of attention is being paid to properties in the vicinity of the Keeley and the Frontier. The Keeley is in excellent condition. Last month's production was 80,000 oz.; if this rate is maintained it will put the company well up among the leading producers.

Properties in Gowganda are also coming to the front, and numerous stories are current about reported transfers of property in that district. Progress is being made with the hydro-electric installation at Indian Chutes, which will soon be in a position to supply the Castle property. The latter company is making plans for a fifty-ton mill.

Nipissing again has declared the regular quarterly dividend of 3 per cent, together with a 3 per cent bonus, payable Oct. 20 to holders of record Sept. 30.

During the week ending Sept. 22, fifteen cars of ore were shipped from Cobalt. Of this tonnage Nipissing shipped nine cars of residues and the Mining Corporation five cars of residues, and the O'Brien shipped 60,000 lb. of high grade.

Kirkland Lake—The Canadian Kirkland shaft is down 300 ft., and will be continued to 400 ft. before a level is established. Extensive improvements to surface equipment are being made.

The Thompson-Chadbourne interests have dropped their option on the Elstone-Dunkin claims, in Gauthier, on account of the heavy payments which are now falling due under the original option.

At the 275 level of the Crown Reserve property, in Larder Lake, a third vein was cut in the shaft. The vein is about 4 ft. wide and is reported to contain extraordinarily high values.

Porcupine—Dome directors have declared the regular quarterly dividend of 50c. a share, payable Oct. 26 to holders of record Oct. 6. As anticipated, no repayment of capital was announced. This will likely come early in the new year.

It is proposed to erect a memorial at Porcupine in honor of Benny Hollinger, the discoverer of the mine which bears his name. The estimated cost of the memorial is $10,000, and if the plan materializes it will be put up on the Hollinger property.

The Davidson has decided to sink a three-compartment incline shaft 1,000 ft. deep. This will be the first inclined mine shaft at a northern Ontario gold mine.

MEXICO

Sundry Activities in Chihuahua and Coahuila

Chihuahua—The Prieta mine at Parral, now being operated by the American Smelting & Refining Co., is producing upward of 2,000 tons of ore per month. The pumps are handling 1,200 to 2,000 gal. of water per minute. S. E. Reed is superintendent.

The Penoles Co. has taken option on the Esmeralda mine, and is making preparations to unwater the mine and sample same. The superintendent is W. J. Moir.

The Veta Grande Unit of the American Smelting & Refining Co. is producing about 800 tons per day. This ore is being cyanided in the mill on the property. W. Sharp is in charge.

The San Pedro mine, near El Valle, is being reopened by W. B. Gates and F. Zuech. This mine was a small producer of silver ore assaying about 100 oz. silver per ton.

Several important American silver-lead mining companies will soon begin shipping silver-lead ore from their mines in Chihuahua, Mexico, to the smelter at El Paso, Texas. This has been made possible by the building of a new short-line railroad, known as the Chihuahua & Orient R. R., which connects the mines in Los Lamentos Mountains with the Mexican Central Ry. at Lucero, Chihuahua. The El Paso smelter will handle about twenty tons per day at first. The mines have approximately 400,000 tons of ore in sight.

Coahuila—A good grade of lead ore is being mined in the Desnea mine of the Constancia Co. at Sierra Mojada. W. W. Shelby is superintendent.

The Parrena Co. is operating the San Salvador and Nuevo Almaden mines. S. F. Shaw is superintendent.

The Compania Metalurgica Mexicana is operating the Veta Rica mine, which has been a famous producer in past years. J. A. Hilbert is superintendent. A leasing company is mining lead-silver ore in the Fortuna mine. J. A. Hilbert is in charge.

The American Smelting & Refining Co. is pushing development work in the Jesus Maria, San Jose, Fronteriza, and Oriental mines. Silver-lime ore is being produced in the San Jose mine. Max F. Quinn is superintendent.

BRITISH COLUMBIA

Two Lodes Are Being Developed at Esperanza—Engineer Mine Bonded

By F. H. Mason

Alice Arm—The Esperanza mine continues to develop well. Mining operations are confined at present to two lodes, one giving 18 to 24 in. of high-grade ore and the other 6 ft. of poorer ore, with 1 ft. of high-grade on the hanging-wall side. Ore is being sacked, but transfer to the wharf has been suspended until the winter sets in, as it can be sledded over the snow right to the wharf much more cheaply than it can be hauled in wagons.

The Homestake Mining & Development Co., which suspended operations some time ago on account of litigation over some of the claims, will resume operations at once and continue through the winter, the dispute over the claims having been settled.

Anyox—The Granby Consolidated M. S. & P. Co. is appealing a case before the November session of the Privy Council, in connection with discount on income tax, amounting to $430,000.

Atlin—The Engineer mine has been bonded by Timmins Brothers, the well-known Ontario mine operators, conditionally to the Privy Council upholding the decision of the British Columbia Supreme Court, which vested the title to the property with the heirs of the late James Alexander. The case comes up for hearing in November, and, as the Privy Council is the final court of appeal, it will settle the ownership of the property. The case has been dragging through the courts since 1917. The Engineer is generally spoken of locally as being a fabulously rich mine, and it is true that some unusually rich ore has been taken from it. Although there are some twenty-five lodes on the property, mining operations have been confined to two or three veins, and most of the gold has been taken from a narrow chimney, which, so far, has not been bottomed.

Stewart—Exploration at the Big Missouri has been so satisfactory that it has been deemed advisable to put on a large force of men, in the hope of getting the Premier road completed to the mine before winter sets in, so that ore shipments may be made over the snow this winter.

Lindborg Brothers have established a camp at the Riverside group, and have installed a compressor.

A trial shipment of high-grade ore has been made from the Lucky Boy group.

The American Mining & Milling Co. is taking supplies for winter use to its property on Fish Creek, and the wagons are returning loaded with high-grade ore, which is being stored on the wharf at Hyder.

The Premier Gold Mining Co. has completed ten cottages for its married men. The tramway is delivering nearly two thousand tons of ore and concentrate weekly.

ALASKA

Alaska Juneau Mill Capacity Now 6,000 Tons per Day

Juneau—The statement of earnings for the first eight months of 1922 by the Alaska Juneau Gold Mining Co. shows that the corporation earned a profit on its capitalization for the first time since 1914. Earnings of August and June were sufficiently large to overcome deficits in the other six months of the year. The detailed figures are announced as follows:

Tons of ore trammed, 1,389,560; tons of ore milled, 710,740; gold, silver, and lead recovered, $809,600; total expenditures, $676,000; profits from operations, $133,600; interest on funded debt, $128,500, net, $5,600. In the same period of time the corporation added $56,500 to capital account. The mill capacity of the corporation has recently been increased to above 6,000 tons per day.

The Treadwell Mining Co. intends to use caterpillar tractors in the haulage of ore from its mines in the Mayo district this winter. The operators found this method of transportation successful during the summer and are convinced that it can be adapted to the snow roads. The company has 2,500 tons of silver ore in sight for shipment. Keno Hill, Ltd., will use horses and sleighs after the close of the river for the transport of between 3,500 and 4,000 tons of ore. This winter's shipments are expected to be double those of last year in volume, and most of the output has already been mined and stacked.

It is reported that the Treadwell company has made another strike of silver ore at the 200 level, the vein being from 8 to 12 ft. wide. Assays are said to show 300 oz. of silver per ton. A shaft is to be sunk to the 400 level, and, if the values are maintained at that depth, it is the intention to install a small concentrator.

WASHINGTON

Activity Increases in Republic District —Knob Hill Being Developed

Springdale—Regular shipments are being maintained from the old Cleveland property, now under operation by Santa Rita Mining Co. Net smelter returns are reported to average $140 per ton.

Republic—Greater mining activity is apparent here than for some time. In addition to resumption at the Last Chance on a scale which promises employment to quite a good sized crew, the Quilp, Surprise, and Old Republic properties are again producing. A recent shipment from the last named brought returns of $200 per ton.

The Knob Hill property, operated by Balaklala Consolidated Copper Co., is being systematically developed. The first work undertaken was deepening of the main shaft. Other work opened a small orebody 90 ft. below the 600 level, which widened to 3½ ft., 20 ft. lower down.

CALIFORNIA

Good Ore in Melones Mine

Special Correspondence

Grass Valley — Approximately 950 men are on the combined payrolls of the Empire and North Star, making both of the mines among the most important gold-producing mines in the state. The Idaho-Maryland is still on a development basis. The Grass Valley Boundary mine is installing new equipment. At the Normandie-Dulmaine the 300-ft. level will soon be reached in shaft sinking.

Melones—At the Melones group of mines, operated by the Carson Hill Gold Mining Co., the main winze is being sunk from the 3,000 to the 4,000 level. Development work is disclosing a satisfactory ore showing. The Chaparral Hill group of claims is being rapidly developed. The Hardy shaft has reached the 300 level, and the erecting of the necessary sinking machinery at the Tullock has been about completed. Thirty-two men are employed on the Chaparral group.

Plymouth — At the Plymouth encouraging results have been obtained at the 3,655 level. Sinking of the main winze below this level will start soon. The working shaft of the Plymouth will be sunk from the 3,400 to the 3,655 level without delay. One hundred and forty men are employed at the mine.

NEVADA

New Vein Reported in West End Mine —First Shipment of Bullion from White Caps Mill

Tonopah—Bullion shipments from the Tonopah district, representing clean-up from operations for the first fifteen days of September, are slightly below normal. The Tonopah-Belmont shipped $94,300, the West End $64,300, the Tonopah Mining $60,000, and the Tonopah Extension $56,000.

It is reported that the West End has cut a new vein on the 400 level from its Ohio shaft. Not sufficient work has as yet been done to determine its extent or value, but it is said to be a promising find. Tonopah Extension work on the deeper levels from the Victor shaft has been somewhat curtailed of late owing to water troubles. The water has been lowered to the 1,804 intermediate level, and satisfactory progress is being made. It is reported that the Belmont, in sinking the Buckeye shaft, has encountered at a depth of 1,380 ft. a large vein which contains low grade but commercial values.

Royston—The Hudson shaft is now 520 ft. deep, and a crosscut to the vein at the 500 level shows good values. No further sinking is contemplated at present, on account of inadequate compressor facilities for sinking and crosscutting at the same time. The hoisting equipment is adequate to sink 300 ft. deeper. Drifts will be continued on the 300, 400, and 500 levels; from the 400 level a raise has been following 2 ft. of good ore for the last 30 ft. The last shipment from above the 500 level is said to have averaged $156 per ton.

The Canadian Leasing Co., which is operating the Betts or "original" discovery, has picked up the faulted segment of the Betts orebody in the foot wall, and a west drift shows 3 ft. of good ore. A thirty-ton lot of ore which is expected to run about $250 per ton is about ready for shipment.

Manhattan—The first bullion shipment made by the White Caps Co., on Sept. 19, was valued at about $15,000. This represented thirteen days' operations. The management has stated that an average recovery of nearly 85 per cent is anticipated. About fifty men are employed in mine and mill and seventy tons of ore is handled daily.

UTAH

Bingham Needs Unskilled Laborers More Than Miners—Park-Utah Leads Park City Shippers

Bingham—The Utah Consolidated is employing a large force in its mine and mill, and is shipping 600 tons of ore daily over its tramway to Tooele. Much of this ore is being milled at the new milling plant, and the rest goes directly to the smelter. In general, as work in the camp of Bingham is extended, the supply of skilled labor as reported by underground mines is increasing as more men come in from the coal camps.

The supply of unskilled labor is understood still to be short. The Ohio Copper Co. is working on a plan whereby it plans to leach its low-grade copper ores in place. Following successful experiments on a small scale, which brought a quick return, arrangements are being made for the installation of a plant of large enough capacity to handle 1,000 gal. of water per minute. The water will be supplied through the Mascotte tunnel.

Shipments by Bingham mines exclusive of the Utah Copper and Utah Consolidated for the week ended Sept. 23 amount to 71 cars. Shippers were: United States Mining, 35 cars; Utah Apex, 24; Bingham Mines, 7; Montana-Bingham, 5. The Utah Copper Co. is working thirteen steam shovels, and shipping an average of 17,000 tons of ore daily to its mill at Garfield.

Alta—At the Alta Tunnel & Transportation mine, in Big Cottonwood Canyon, more ore has been opened in the back of the stope near the No. 3 raise, and six mine cars have been taken from this find. New ore has also been found in the Christmas raise.

Park City—Shipments for the week ended Sept. 23 amount to 3,965 tons. Shippers were: Park-Utah, 1,212; Judge and Park City Mining & Smelting, 964; Ontario, 922; Silver King Coalition, 867 tons. Oddly enough the Park-Utah, the new shipper of the camp, heads the list with 1,212 tons, making a daily average of production of 173 tons for the seven days ended Sept. 23, as compared with 138 tons daily for the seven days preceding.

Eureka—Tintic shipments for the week ended Sept. 23 amount to 151 cars. Shippers were: Chief Consolidated, 38 cars; Tintic Standard, 31; Grand Central, 22; Colorado, 11; Eagle & Blue Bell, 10; Iron Blossom, 7; Centennial-Eureka, 6; Victoria, 5; Dragon, 4; Gemini, 4; Swansea, 3; Tintic Drain Tunnel, 2; American Star, 2; Mammoth, 2; May Day, 1; Bullion Beck, 1; Showers, 1; Yankee, 1. In addition to this, the Chief shipped 14 cars of limestone.

The Bingham Mines Co., which owns the Dalton & Lark and Yosemite mines, in Bingham, and the Victoria and Eagle & Blue Bell, in the Tintic district, has applied for listing on the Salt Lake Stock Exchange. The application, signed by James P. Graves, president of the company, and Thomas S. Woods, secretary, shows the company to be incorporated for $1,500,000 in 150,000 shares, of par value of $10 each, the company having been organized April 3, 1908, and having 496 stockholders of record June 30, 1922. It has no promotion stock and no liabilities.

IDAHO

Talache Mines Co. Increases Output

Talache—The Talache Mines Co. is preparing to increase its force of men by fifty on Oct. 10, according to announcement made by Superintendent A. H. Burroughs. This will make the force employed there between 200 and 225, and the output of ore will reach 200 tons daily. Work of enlarging the housing accommodations for the increased force is practically completed.

Pine Creek — The Amy-Matchless mine has 4 ft. of milling ore and nearly 20 in. of high grade in a raise 125 ft. up from the main tunnel, according to G. A. Smith. The raise was started in the vein at the 3,000-ft. station in the tunnel at a point where there was a foot of ore. When up 40 ft. this had increased to 3 ft. of milling ore, with a foot of high-grade lead-silver along the foot-wall side.

Hope—Development operations are again being resumed on the property of the Auxier Gold Mining Co., after a delay of several months on account of damage to mining equipment by a fire last spring.

Adair—Further improvement is noted in the drift being carried easterly on the Monitor vein of the Idaho-Montana Copper Co.'s deep workings.

Grangeville—Winter supplies aggregating $25,000 in value have been packed in recently to the Bear Creek section, for use in the mining operations projected there.

Priest River—More than an ordinary amount of mining development has been carried on this season on Pine Creek, eight and one-half miles from here. Among properties being worked are the Camp Bird, Cuban and Tiger.

Clarks Fork—The long tunnel on the Clarinda Copper Co. has encountered what is believed to be the vein for which it has been driving for the past two years. Ore is expected when the vein is opened by drifting. A new discovery has been made a mile and a half from Clarks Fork, where 18 in. of clean galena has been exposed for more than 60 ft.

ARIZONA

Silver-Gold Strike Near Phoenix—Good Ore Opened at Three R Mine

Phoenix—Remarkable silver-gold ore, assays running up to $500 a ton, has been brought in from the Clanton cattle range, about ninety miles west of Phoenix and forty miles west of the Buckeye branch of the Arizona Eastern Ry. The samples come from a hole 12 ft. deep. The find is in a rough desert country, five miles from any present water supply.

Patagonia—Development work at the Superior-Patagonia Copper Co.'s Three R mine is reported to have uncovered high-grade copper ore. The work is being managed by E. F. Bohlinger.

The well-known Morning Glory mine, near Mowry, is installing heavy surface machinery in preparation for the shipment of a carload a day to the Copper Queen smelter. C. B. Wilson, owner, is in charge.

Prescott—The Big Ledge Copper Co. has been placed under the receivership of W. W. Lytzen, who for three years past has been superintendent. The company has been sued by the Arizona Power Co. for current delivered to the Henrietta mine, at Huron.

Jerome—Steam shovels on the 300 level of the United Verde are working in converter ore; the rest of the winter will be required to make a distance of 400 ft. to the old glory hole. Material is being removed at the rate of 2,500 yd. a day.

Sulphide ore worth $40 a ton, as sampled across 4 ft., has been found at 875 ft. in the Shea shaft. A station will be cut at 900 ft., where drifting will start.

COLORADO

Tonopah-Ajax Operations To Start Oct. 15

Cripple Creek—Rapid progress is being made by the Tonopah-Ajax company in putting the surface plant in first-class condition and timbermen have started work in the shaft to prepare for operation. Mining will begin about Oct. 15, depending on the amount of work necessary to repair the shaft.

Telluride—Mine operators announce a revision of their wage scale. Machine men are advanced from $4 to $4.50; muckers from $3.50 to $4; and surface labor remains at $3.50 per shift.

Breckenridge—It has been announced that the Wellington company, which has been operating on a most limited scale for the last two years, on account of the conditions in the zinc market, will resume full operations of its mines and mill as soon as the crews can be assembled. The Wellington is one of the large zinc mines of the state.

The Tom Thumb mine has been leased by Daniel Stukey, Archie Wurkins, and C. C. Irwin, who are at work on driving the old Price tunnel to connect the Tom Thumb vein, and their survey shows a distance of only 300 ft. should reach a good vein from which galena and lead carbonate shipments have been made for many years past.

Hahn's Peak—The Hahn's Peak Gold Mining & Milling Co. owns twenty-five patented claims having over three miles of underground openings. Diamond drilling is being done to explore orebodies to 2,000 ft. depth. Harry A. Granberg is superintendent. The ore carries gold and silver principally. Many prospectors are at work in the district, which has never been thoroughly explored.

MICHIGAN

One Thousand Miners Could Find Work in Lake Copper Country

By M. W. YOUNGS

Houghton—Copper Range, Quincy, and Mohawk made a net gain in men in September, as they did in August, but these properties are still short of labor—a condition which may continue throughout the winter. It is estimated that fully 1,000 more men could be used. Some experienced men are coming from other points, and men who work on farms in summer are beginning to return to the mines, but not in sufficient number to supply the demand. Calumet & Hecla has been more fortunate in its labor supply, and for the present at least is full handed in its conglomerate shafts. The same condition exists at the Ahmeek.

Coal shipments are again being received. Cargoes have been unloaded at the Calumet & Hecla, Quincy, and Copper Range docks, and coal is on the way for the Stanton mines. Stocks will not be as heavy as in former years, but if receipts are sufficient to last until April 1, none of the mines will be forced to suspend.

The mining companies of both Houghton and Keweenaw counties will benefit this year by reductions in assessed valuations of the two counties. Houghton County has been equalized at $67,000,000, against a recommended valuation of $90,000,000, and Keweenaw has been reduced from $20,000,000 to $16,000,000. The state rate remains unchanged at $3.46, and as the mining companies pay approximately 80 per cent of the taxes in both counties, a considerable saving will result.

The Wolverine stamp mill has suspended operations temporarily, all Wolverine rock now being stamped in the Mohawk mill. This was made possible by reduced shipments from Mohawk, and the fact that the Mohawk mill had not previously operated to capacity. Mohawk, however, will show an increase for September as compared with August. The August output was under 800,000 lb., owing to loss of underground men, but with a net gain in men in September production will be close to 900,000 lb.

Arcadian Consolidated is drifting both north and south from the 1,250 or bottom level of the New Baltic shaft, and is in 50 ft. in each direction. The vein is wide and strong and fairly well mineralized.

MINNESOTA

Output of State-Owned Mines Is 130,012 Tons for Current Week

Hibbing—Total mine shipments from state-owned properties for the last week amounted to 130,012 tons, which is a small decrease from the preceding week. Shipments were divided as follows: Wanless, 2,820 tons; Hill-Annex, 27,252 tons; Missabe Mountain, 84,280 tons; Pilot, 4,080 tons; Fay, 7,611 tons; Leonidas, 21,119 tons; Morton, 6,106 tons; Pool, 980 tons; Majorca, 5,564 tons.

Chisholm—Owing to the proposed underground work at the Alexandria mine, operated by the M. A. Hanna Ore Co., it has been found necessary to move the houses from the old location. The new work includes the development and operation of the ore which was recently proven by drilling and which was found to underly the houses that are being moved.

Marble—The Balkan Mining Co. has completed its plans for the removal of additional stripping at the Danube open pit. This work contemplates the stripping of 1,500,000 cu. yd. of overburden.

JOPLIN-MIAMI DISTRICT

Treece, Kan., Is Scene of New Operations

Miami—The Southern Lead & Zinc Co., owned by F. W. Evans, of Joplin, and associates, is sinking a new shaft on a forty-acre lease adjoining a mill lease near Treece, Kan. It has reached a depth of 175 ft. Unwatering at the new Juanita mine, three miles north of Treece, has been completed after a three-months' fight, and the plant has started operation. It has a modern concentrator and is situated on the northern edge of the Picher-Treece field.

The Dorothy Bill Mining Co. has taken over the Niangua property, one mile west of Picher, and it will be known as the Dorothy Bill No. 2. The company has held an option on the Niangua from the Quapaw-Tulsa Mining & Investment Co. for three months. The mill will be thoroughly overhauled and put in first class condition before being started.

An $8,000 steam tailing shovel is being installed at the Blue Mound mine by McGhee Brothers and Jesse, of Joplin, who are to operate the plant as a tailing mill. They expect to start up about Oct. 10.

About thirty small mines are now operating in the vicinity of Granby, Mo., after an idleness of almost two years, and are producing about 200 tons of calamine weekly. The price of calamine has climbed to $22.50 basis, making about $25 for most of the Granby ore.

The White Mining Co. will sink a new shaft, its third, a short distance to the south of its mill at Picher, where six drill holes recently were put down to test the ground. The company recently made good drill strikes about 700 ft. west of its mill and another shaft may be put down in that vicinity. Otis W. White is manager.

The Present Situation at the Mines

By Arthur B. Parsons
Assistant Editor *Engineering and Mining Journal-Press*

WAGES of metal miners are on the upward trend. In a review of the situation in the industry written less than two months ago I stated that the outstanding feature was the shortage of competent miners; and that complaint to this effect came from virtually every mining region in the country. The statement was made that a low point in the wage curve had apparently been passed. The Shasta Zinc & Copper Co. had just increased the wages of its employees 25c. per day. This seemed to break the ice, and since then an epidemic of wage-raising has swept the base-metal-mining industry. Utah, Arizona, Michigan, Idaho, Nevada, Montana—is about the order in which the announcements came.

No better illustration of automatic readjustment under the economic law of the equilibrium at some wage between supply and demand could be imagined. The demand for miners temporarily exceeded the supply; the only way to increase the supply was to increase the inducement for men to work in the mines; and the one simple and effective inducement is higher wages. Whether the increases that have been made already will be adequate to attract the desired number of men remains to be seen. If they fail to do so, the only recourse will be to make further increases or else to revise downward the tentative schedules of output. For the sake of the copper producers, especially, it is to be hoped that no additional burden in the way of wages will be necessary. One source of comfort for them is the fact that the approach of winter always draws experienced miners from the farms, the logging camps, the oil fields, and scenes of other outdoor labor at which the men are accustomed to work the winter's accumulation of dust and powder smoke out of their lungs.

Contrary to numerous published statements, the copper-mining companies generally have not returned wages to the war maximum, as can be seen from the accompanying table. Butte is still one dollar below the $5.75 that prevailed for more than a year before the armistice; and the Lake copper companies in Michigan are still $1.25 below their maximum. It may be pointed out that, by way of compensation for the low wage rate, the Michigan companies rent comfortable homes to their employees at the exceptionally low rate of $1 per room per month, coal for domestic purposes is supplied at actual cost, and water is free.

Another significant point in the situation in Michigan is that the Calumet & Hecla and subsidiary companies are paying their miners considerably in excess of the established wage scale under the provisions of a bonus system that is operating successfully.

One possible way out of the present dilemma—the labor shortage—is the establishment of a fair and honest bonus or contract plan of paying miners. The American Zinc, Lead & Smelting Co. at Mascot, Tenn., is paying as much as $7 and $8 per day, which is equivalent to at least $10 or $12 in the high-scale districts of the West, and is mining more ore per man-shift at a lower per-ton cost than it ever has before. If properly administrated, a good bonus system does all of the three things that are most sought for at this time: (1) it reduces the total number of men required to produce a given tonnage; (2) it increases the individual income of the miner; and (3) it reduces the cost of producing a ton of ore. The trouble is that very few managers seem to be sufficiently sagacious and diplomatic to make a bonus scheme work. Nevertheless, the adoption of such schemes may prove to be the solution of the present difficulty.

One interesting fact revealed in the table of wages is that the gold and silver producers generally have not increased wages; the sufficient reason is that they did not reduce them in 1920 so drastically as did the base-metal companies. The wages shown in the table are those paid for miners. With the exception, I believe, of Butte there is a differential of 50c. per shift in favor of the miner as compared with the trammer or shoveler. Butte, dominated by the Anaconda company, sticks to the single-scale system.

The rates of production of all three major metals—copper, lead, and zinc—are increasing; the increase would doubtless be more marked except for the limitations placed upon operations by the number of available miners. Of more moment than the actual statistical increase of output is the preparation for early additional production.

Michigan copper production for September is estimated at 11,700,000 lb., compared with 10,025,000 lb. for August. Calumet & Hecla increased its output to 5,000,000 lb. by stamping rock of considerably higher grade, drawn from upper levels.

At Butte, Anaconda continues at the rate of about 15,000,000 lb. of copper per month; North Butte has increased production to about 1,500,000 lb. monthly; and the Davis-Daly has added a night shift with the expectation of hoisting 700 tons of ore per day. Utah Copper, at Bingham, is producing 10,000,000 lb. per month, and Nevada Consolidated, at Ely, has restarted part of its mill destroyed by fire on July 9. The Consolidated Coppermines Co., neighbor of Nevada Con., will begin active mining with 250 men.

MINERS' WAGES AT DIFFERENT PERIODS IN VARIOUS DISTRICTS

District	Dec., 1918	Aug. 1, 1922	Oct. 1, 1922
Copper			
Globe-Miami, Ariz.	$5.90	$4.50	$4.95
Copper Country, Mich.	4.90	3.15	3.65
Ely, Nev.	5.50	4.25	4.75
Engels-Walker, Calif.	4.50	4.50	4.50
Butte, Mont.	5.75	4.25	4.75
Bingham, Utah	5.25	3.75	4.75
Lead-Zinc			
Coeur d'Alene, Idaho	5.50	4.25	5.00
Tintic, Utah	5.00	4.00	4.75
Picher, Okla.	5.25	3.25	3.75
Shasta, Calif.	....	4.00	4.25
Silver-Gold			
Tonopah, Nev.	5.50	5.25	5.25
Cripple Creek, Colo.	4.50	4.25	4.75
Oatman, Ariz.	5.50	5.00	5.00
Homestake, S. D.	4.25	4.25	4.50
Grass Valley, Calif.	4.00	4.50	4.50
Randsburg, Calif.	....	6.00	6.00

In California, the Engels mine and Anaconda's Walker property are outputting at capacity. Together they account for about 2,500,000 lb. of metal. Old Dominion, in Arizona, has increased output to about 2,900,000 lb. per month. Miami made well over 6,000,000 lb. of metal in September. In Chile, the Braden company is producing 10,000,000 lb. per month, and in August the Chile Copper Co. turned out 13,141,000 lb. for a new high production record.

Following several weeks of rumors and denials, definite announcement has been made of the resumption by the Callahan Zinc-Lead Co., in the Coeur d'Alene region of Idaho, after two years' shutdown.

At Great Falls the Anaconda company's plant is turning out nearly 11,000,000 lb. of electrolytic zinc monthly. This is almost its maximum capacity. Except for small shipments from the Emma, the concentrates for the Great Falls plant come from the Butte & Superior mine and Senator Clark's Elm Orlu, which, with zinc at near 7c., limit their output only by their ability to get miners and the terms of their contracts with Anaconda.

In the Joplin-Miami lead-zinc field 107 mines are in operation; the weekly output of concentrate exceeds 10,000 tons.

Indicative of the increased activity in zinc mining is the starting of new furnaces by the Bartlesville Zinc Co. in Oklahoma. At Bartelsville six blocks are operating, and at the Blackwell plant, three.

Precious-metal mining continues to be healthy. In Virginia City, Nev., machinery has been turned over in the new 2,000-ton plant of the United Comstock Co. A new mill, the White Caps, has started treating seventy tons of ore per day at Manhattan. Tonopah's monthly production, $600,000, was below normal. The shortage of experienced miners retarded gold production at Cripple Creek during September, but new oreshoots are being developed satisfactorily. The Homestake and Trojan companies, in South Dakota, produced $575,000 in bullion during September; the first unit of the Homestake's new South mill is in operation.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
28	13.75	32.125	32.50	6.35@6.60	6.25@6.30	6.825@6.875
29	13.75	32.25	32.75	6.35@6.60	6.25@6.30	6.775@6.85
30	13.75	32.50	33 00	6.35@6.60	6.25@6.30	6.775@6.825
Oct. 2	13.75	32.625	33.00	6.35@6.50	6.25@6.30	6.775@6.80
3	13.75	32.50	33.00	6.35@6.50	6.25@6.30	6.75 @6.80
4	13.75	32.25	32.75	6.35@6.50	6.25@6.30	6.75

*These prices correspond to the following quotations for copper delivered: Sept. 28 to Oct. 4 inc., 14c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
28	63 5/8	64 1/4	71 1/2	161 5/8	162 3/4	24 3/4	24 1/8	32 3/8	32
29	63 7/8	64 3/8	71 1/2	163 3/8	164 1/2	24 7/8	24 1/4	32 1/2	32 1/8
Oct. 2	63 5/8	64 1/8	71 1/2	164 3/8	165 3/8	24 5/8	24	32 5/8	32 1/4
3	63 1/2	64 1/4	71 1/2	164 3/4	165 5/8	25	24 3/8	32 7/8	32 3/8
4	63 1/4	63 7/8	71 1/4	163 1/4	163 5/8	24 7/8	24 1/4	33	32 3/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Oct.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
28	4.39	99 1/4	69	35 5/16	2	4.38 3/4	99 1/4	69 1/4	35 7/16
29	4.36 5/8	99 1/4	68 1/2	35 5/16	3	4.39 1/4	99 1/4	69 1/8	35 7/16
30	4.37 1/8	99 1/4	68 7/8	35 3/8	4	4.40 1/2	99 1/4	69 3/8	35 3/8

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Average Metal Prices for September

Copper:	
New York Electrolytic	13.748
London Standard	63.113
London Electrolytic	70.917
Lead:	
New York	6.110
St. Louis	5.868
London	24.131
Silver:	
New York, foreign	69.515
New York, domestic	99.250
London	35.305
Sterling Exchange	442.800
Zinc:	
St. Louis	6.548
London	31.750
Tin:	
99 per cent	32.075
Straits	32.395
London	160.065
Antimony	6.580
Quicksilver	67.640
Platinum	117.280

Metal Markets

New York, Oct. 4, 1922

The metal markets have been somewhat quieter during the last week, though the reason is not evident. Prices show but little change from the previous quotations.

Copper

The copper situation is unchanged. Practically all producers continue to quote on a 14c. delivered basis, and satisfactory tonnages have been sold at that level. A slight shading of price has, in some instances, been made where the delivery point was near the refinery, but these have been offset by some tonnages sold for far-away points as high as 14⅛c. Domestic consumption continues excellent; practically all brass mills are operating at capacity.

Only slight interest is manifested in the forward market, practically all sales having been made for only the next three months. For first-quarter 1923 delivery, business at 13.70@13.75c., f.o.b. refinery, has been done.

Conditions in the export market are substantially unchanged.

Lead

The official contract price of the American Smelting & Refining Co. continues at 6.35c., New York.

The lead market kept up well on Thursday, Friday, and Saturday, with practically all producers out of the market except to regular customers, and with the dealers quoting prices up to 6.75c. Little or no business was actually booked at this high level, however. In the last three days, the market has been distinctly easier, and prompt metal has been easily available for 6.60c. Most of the metal sold by producers to consumers during the week has been for October or November shipment and at prices from 6.40 to 6.50c. Conditions are fundamentally sound, and no price reaction of any moment is expected in the immediate future.

Lead has been available in the St. Louis market at from 6.25 to 6.30c. all week, though producers have not been anxious sellers. In Chicago, desilverized lead was offered at 5 points above this range, and a fair tonnage was sold.

Freight embargoes have been troublesome to producers and consumers alike, interfering with shipments of the crude metal and finished products, though possibly not to the extent that has been true in the zinc industry.

Zinc

The price of zinc has exhibited a mild reaction, though fundamental conditions are excellent. The reversal in the price trend has been due to a dearth of orders, caused largely by the freight embargoes that have been declared by many roads. These, coupled with a shortage of fuel and scarcity of labor, have compelled consumers to operate on a smaller scale than they expected and

than would have been justified by the order books. The slackness of demand and accompanying price depression are therefore thought to be temporary. Prices of spot zinc are slightly higher than those we quote, which represent the major market. New York prices continue at 35 points advance over St. Louis, and high-grade zinc remains at 7.75c. with freight allowed.

Tin

The tin market has been reasonably active, and prices have advanced slightly; the favorable statistics at the end of the month were no doubt a contributing factor. Deliveries into domestic consumption for September were stated by the New York Metal Exchange to be 5,050 long tons.

Arrivals of tin, in long tons: Total for September, Atlantic ports, 3,430; Pacific ports, 50; total, 3,480. Oct. 2, Straits, 2,590; China, 460; Liverpool, 45. Total visible supply, Sept. 30, 22,879, compared with 24,176, Aug. 31.

Gold

Gold in London: Sept. 28th, 93s. 10d.; 29th, 93s. 10d.; Oct. 2d, 94s.; 3d, 93s. 9d.; 4th, 93s. 8d.

Stock of money in the United States, Sept. 1, 1922: Gold coin and bullion, $3,858,548,202; standard silver dollars, $394,444,404; subsidiary silver, $270,701,710; United States notes, $346,681,016; Federal Reserve notes, $2,603,730,960; Federal Reserve Bank notes, $69,737,400; National bank notes, $759,705,549; total, $8,303,549,241. Circulation per capita, $39.93, compared with $39.47 in the month previous. During the month gold stocks increased $34,000,000 and silver, $9,000,000.

Foreign Exchange

On Tuesday, Oct. 3, francs were 7.58c.; lire, 4.265c.; marks, 0.05c.; and Canadian dollars, 3/32 per cent discount.

Silver

The silver market has continued quiet but steady in London. New York has remained dull with slight fluctuations due to lower rates on sterling exchange during the latter part of the month. The market closes quiet and steady.

Mexican Dollars—Sept. 28th, 52⅝; 29th, 52⅜; 30th, 52⅝; Oct. 2d, 52⅞; 3d, 53; 4th, 53c.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—Rumors are current that the Aluminum Co. of America has advanced its prices 2c. per lb. Telegraphic advices from the head office in Pittsburgh state, "We have no published prices. Our prices vary according to quantity and quality, but it may be said that prices are now from 1 to 2c. stronger than they were a month or six weeks ago." The outside market for 99 per cent virgin metal has advanced to 21c. per lb.

Antimony — Chinese and Japanese brands, 7c.; easier. W. C. C., 7.25@7.50c. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal, 4.50c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5¼c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 6.75@7c.

Bismuth—$2.20 per lb.

Cadmium—$1.15 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2 per lb. in bbls.

Iridum—$275@$300 per oz. Metal exceeding scarce.

Magnesium—Sticks, 1⅛ in., 99.9 per cent, $1.25 per lb.

[1]**Molybdenum Metal**—In rod or wire form, 99 9 per cent pure, $32@$40 per lb., according to gage. Powder, 95 per cent, $2.50@$3.50 per lb.

Monel Metal — Shot, 32c.; blocks, 32c. per lb., f.o.b. Bayonne, N. J.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market quiet at 32@34c. per lb.

Osmium — No quotation reported. Recently $70 per troy oz.

Palladium—$55 per oz.

Platinum—$112 per oz.

Quicksilver—$71 per 75-lb. flask. San Francisco wires $70.70. Strong.

[1]**Rhodium**—$100@$115 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $1.80@$1.90 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $18@$20 per lb.

[1]**Tungsten Metal**—Powder, 97 to 98 per cent, 75c.@$1.05 per lb. contained tungsten.

Metallic Ores

Chrome Ore—Indian chrome ore at $18 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, $23 and $25 per ton. Market quiet.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $5.95; Mesabi bessemer, 55 per cent iron, $5.70; Old Range non-bessemer, 51½ per cent iron, $5.20; Mesabi non-bessemer, 51½ per cent iron, $5.05.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.50 per long ton; old bed concentrates, 63 per cent, $5.25; Harmony, cobbed, 63 per cent, $5.25; new bed low phosphorus, 65 per cent, $7.50.

Manganese Ore—29c. per long ton unit, seaport, plus duty; equivalent to about 45c. Chemical ore, $70@$75 per gross ton.

Molybdenum Ore—50@55c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates, plus duty; equivalent to 80@85c. per lb.

Tantalum Ore—Hand-sorted ore, 70 per cent combined columbite-tantalite, 40c. per lb., South Dakota.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 96 per cent TiO_2, 9@10c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Chinese ore, $7.50 per long ton unit of WO_3.

Uranium Ore (Carnotite)—Ore containing from 2 to 2½ per cent U_3O_8, $3.50 per lb. of contained U_3O_8.

Vanadium Ore—No quotation. Recently $1 per lb. of V_2O_5 content.

Zircon — Zirconium silicate, f.o.b. Pablo, Fla., 4½@13c. per lb.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 30.—Zinc blende, per ton, high, $42; basis 60 per cent zinc, premium, $42.50@$43; Prime Western, $40@$41.50; fines and slimes, $40@$38; average settling price, all grades of blende, $38.60; calamine, per ton, 40 per cent zinc, $22.

Lead, high, $85.90; basis 80 per cent lead, $85; average settling price, all grades of lead, $82.04 per ton.

Shipments for the week: Blende, 6,524; calamine, 32; lead, 1,350 tons. Value, all ores the week, $363,270.

Shipments for nine months: Blende, 338,863; calamine, 1,413; lead, 67,418 tons. Value, all ores nine months, $15,270,280.

Buyers generally expected to fill orders on $40 basis Prime Western up to noon today, but sharp demand advanced prices to $41 and finally to $41.50, with premium as high as $43 basis. For two weeks lack of cars has become acute, and shippers are greatly inconvenienced. So much ore is held in transit that some smelters are reducing their ore stock at the smelting works so low that there is grave danger of necessitating dead-firing some furnaces.

Platteville, Wis., Sept. 30.—Blende, basis 60 per cent zinc, $44 per ton; lead, basis 80 per cent lead, $85 per ton. Shipments for the week: Blende, 176 tons; lead none. Shipments for the year: Blende, 14,253; lead, 1,284 tons. Shipped during the week to separating plants, 2,017 tons blende.

Non-Metallic Minerals

Asbestos—No. 1 crude, $600@$800; No. 2, $300@$400; long spinning fiber, $175@$225; magnesia and compressed sheet fiber, $150@$175; shingle stock, $65@$85; paper stock, $27.50@$40; cement stock, $15@$16; shorts, $8@$10, all per short ton, f. o. b. mines, Quebec.

African grades: Crude No. 1, $700@$1,000; No. 2, $350@$500; spinning fiber, $200@$275; paper stock, $35@$40; cement stock, $15@$17.50.

Market improved. Fair demand for Canadian products. Shipments of crudes increasing. Inquiries show manufacturers' stocks being depleted.

Barytes—Crude ore, $8@$9 per ton, f. o. b. mines. Much better tone to market.

Bauxite—American, crushed and dried, $6@$9 per gross ton; pulverized and dried, $12@$14 per gross ton;

calcined, $22@$25 per gross ton, all f.o.b. shipping points. Foreign bauxite offered at $5@$8 per metric ton, c.i.f. Atlantic ports, depending upon grade.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 5¼c. per lb.; in bbls., 5½c. Boric acid, 11c.

Chalk—English, extra light, 5c. Domestic light, 4¼@4½c.; heavy, 3½@3¾c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $6@$8; washed, $8@$9; powdered, $12@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $14@$20, f.o.b. Virginia points. Imported lump, $14@$20, f.o.b. American ports; powdered, $40@$45, f.o.b., New York. 1A grade, refined, $13.50@$15 per ton, Delaware.

Emery — Turkish and Greek manufactured emery, 6@8c. per lb. American, 4@6c. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—No. 1 pottery grade, $6.50@$7.50 per long ton; soap grade, $7, f.o.b. North Carolina points. Ground to 140 mesh, $16@$18 per ton; 40 to 100 mesh, $10@$13, f.o.b. mill. Canadian $20, f.o.b. cars at mill. No. 1, $7.50; No. 2, $6.50, f.o.b. Connecticut points.

Fluorspar—Gravel, $17.50@$20 per ton, f.o.b. Illinois and Kentucky mines; acid lump, $40; enameling and glass grades, $35@$40; No. 1 lump, $35; No. 2 lump, $30.

Fuller's Earth—16 to 30 mesh, $17 per ton; 30 to 60 mesh, $20; 60 to 100 mesh, $19; 100 mesh and finer, $10; f.o.b. Florida mines.

Graphite—Ceylon lump, first quality, 5@5½c. per lb.; chip, 4@4½c.; dust, 3¼@3½c. Mexican crude amorphous, $15@$35.

Gypsum—Crushed rock, $3 per ton in most states. Ground, $3.50@$4, f.o.b. shipping points.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¼ in. and larger, $1.10@$1.35 per net ton. Agricultural limestone, $2.50@$3 net ton, f.o.b. eastern shipping points.

Magnesite—$15 per ton for crude, $35@$37.50 for calcined magnesite, f.o.b. California points. Northwest American magnesite industry shut down.

Mica—Domestic, No. 1 quality, 1½x2 in., 20c.; 2x2 in., 45c.; 2x3 in., 80c.; 3x3 in., $1.30; 3x4 in., $1.70; 3x5 in., $2.25; 4x6 in., $3; 6x6 in., $4.50; 6x8 in., $4.50 all per lb., f.o.b. North Carolina.

Scrap mica, $23 per ton delivered to New Hampshire mill; disk mica, 15c. per lb.; washers, 12c. per lb., f.o.b. Connecticut points.

[1]**Monazite**—Minimum 6 per cent ThO_2, 6@8c. per lb.

Phosphate Rock—Per long ton, Florida ports, pebble grade, for export: 77 per cent tricalcium phosphate, $7.50 ($8.50 for hard rock); 75 per cent, $6.50; 70 per cent, $4.50; 68@66 per cent, $4.25. 72 per cent B. P. L., $6.50 per long ton, Tennessee; 65 per cent, $5.50; kiln dried, unground, 76 per cent, $6.50 @$6.75 per long ton. Market unsatisfactory.

Pumice Stone—Imported lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—In boulder form, $7 per long ton, f.o.b. Massachusetts; concentrates, $9 per long ton.

Silica—Glass sand, generally $1.75@$2.50 per ton, f.o.b. shipping point; sand-blast material, $2.50@$5. Ground 250 to 450 mesh, $17@$50, f.o.b. mills. Glass sand $5@$10, f.o.b. Massachusetts.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—200 to 300 mesh, including containers, $14.25@$14.75, f.o.b. New York state mills; 20 to 50 mesh, $7.50; 150 to 200 mesh, $9@$14 per ton, f.o.b. Vermont points; $1 extra for bags; 200 mesh, $15; 300 mesh, $18.50, f.o.b. California points. Powdered talc in Georgia, $8.25@$10.25 per ton.

Tripoli—Once ground, rose and cream colored, $16@$22.50; white, $18@$25; double ground, r. and c., $17@$25; w., $19@$26; air-float, r. and c., $25@$30; w., $27.50@$32.50; super air-float, r. and c., $35@$40; w., $40@$45. All per short ton in 200-lb. burlap bags with paper liners, minimum car, 30 tons, f.o.b. Missouri points. Market strong.

Mineral Products

Arsenious Oxide (white arsenic)—firm at 9½c. per lb.

Copper Sulphate — Large crystals, 5.85c. per lb.; small, 5.75c.

Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate — Powder, domestic, $1 per unit, basis 90 per cent, f.o.b. New York.

Sodium Sulphate—$25@$27 per ton, New York.

Ferro-Alloys

Ferrocerium—Per lb., $15@$20.

Ferrochrome—1 to 2 per cent carbon, 25c. per lb.; 4 to 6 per cent carbon, 10½c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $69@$75 per gross ton, f.o.b., furnace. Spiegeleisen, 19@21 per cent, $39, f.o.b. furnace; 16@19 per cent, $38.

Ferromolybdenum—$2@$2.50 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 15 per cent, $38@$40 per gross ton, f.o.b. works; 50 per cent, $62@$65; 75 per cent, $115@$120.

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten — Domestic, 70 to 80 per cent W, 75c.@$1 per lb. of contained W, f.o.b. works.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

Ferrovanadium—$3.50@$4 per lb. of V contained, f.o.b. works.

Metal Products

Copper Sheets — New York base. 21.50c. per lb.; wire, 15.50@15.75c. net.

Lead Sheets—Full lead sheets, 8.75c.; cut lead sheets, 9c. in quantity, mill lots.

Nickel Silver—29.25c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal — Dimension sheets, 19.50c.; rods, 16.50c. per lb.

Zinc Sheets—$8.25 per 100 lb., f.o.b. works.

Refractories

Bauxite Brick—$45@$50 minimum, per net ton, f.o.b. St. Louis.

Chrome Brick—$50@$55 per net ton, f.o.b. shipping point.

Chrome Cement — $23 per net ton, f.o.b. shipping point.

Firebrick—First quality, $43@$46 per M., Pennsylvania, Ohio, and Kentucky works; second quality, $39@$40.

Magnesite Brick — 9-in., straights $75@$80 per net ton, f.o.b. works.

Magnesite Cement—$50.50 per net ton, f.o.b. shipping points.

Silica Brick—$45@$50 per M., Pennsylvania; $53@$58 Indiana; $48@$50 Alabama.

[1]**Zirkite**—Powdered, $50@$60 per ton; brick, $100 per ton.

The Iron Trade

Pittsburgh, Oct. 3.—Delivery premiums are decreasing, and there is a possibility that basis prices, for extended delivery, may decline somewhat before the end of the year. Buyers continue to urge mills to make heavier shipments, but they are making only moderate purchases for early deliveries.

Basis prices have advanced in two cases, the Steel Corporation having advanced wire and nails $2 a ton to 2.45c. and $2.70, and the independents have come down $1, making their prices the same as those of the corporation. The corporation's 1.90c. price on bars disappeared recently, leaving 2.00c. as its price, and one large independent has come down from 2.15c. to 2.00c. and others are in line to name this price. In sheets, prompt deliveries have receded from 3.75c. to 3.60c., shipment in thirty days or more still commanding 3.50c. Automobile sheets are at 5.00c. among independents. Corporation prices of 3.35c. on black and 4.70c. on automobile sheets are nominal, as order books are filled.

Pig Iron—The Cambria Steel Co. has sold 2,000 tons of basic at $30, Johnstown, and 1,000 tons of bessemer at $33.50, and quotes foundry at $32.50, and Johnstown and malleable at $32. Freight to Pittsburgh is $1.77, the same as from the Valleys. There are scarcely any Valley offerings.

Connellsville Coke—Prices are stiffer, at $12 to $12.50 for furnace and $13.50 to $14.50 for foundry, with offerings limited.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1921	1922	1921	1922	1921	1922
January	65.950	65.450	39.985	35.035	372.650	421.750
February	59.233	65.290	34.745	33.891	385.932	435.511
March	56.023	64.440	32.479	33.269	389.806	436.912
April	59.337	66.575	34.250	34.080	391.784	440.715
May	59.810	71.154	34.165	36.023	396.580	444.106
June	58.510	71.149	34.971	35.900	377.236	444.615
July	60.260	70.245	37.481	35.644	362.565	444.165
August	61.597	69.417	38.096	34.957	364.505	446.069
September	66.160	69.515	40.082	35.305	371.725	442.800
October	70.970	.....	41.442	.....	386.315	.....
November	68.234	.....	38.750	.....	396.315	.....
December	65.760	.....	35.645	.....	414.880	.....
Year	62.654	.....	36.841	.....	384.191	.....

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1921	1922	1921	1922	1921	1922
January	12.597	13.465	70.964	65.226	79.119	72.321
February	12.556	12.864	70.925	60.250	75.925	66.125
March	11.976	12.567	67.565	59.245	71.190	65.739
April	12.438	12.573	69.381	58.799	71.786	64.028
May	12.742	13.111	73.196	61.092	74.298	66.554
June	12.697	13.575	71.852	61.988	75.682	69.333
July	12.170	13.654	71.155	63.137	75.286	70.321
August	11.634	13.723	68.614	63.784	72.705	69.932
September	11.948	13.748	67.977	63.113	72.295	70.917
October	12.673	.....	67.327	.....	73.476	.....
November	13.035	.....	66.614	.....	74.386	.....
December	13.555	.....	66.706	.....	74.525	.....
Year	12.502	.....	69.356	.....	74.223	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1921	1922	1921	1922	1921	1922
January	4.821	4.700	4.747	4.388	23.387	23.667
February	4.373	4.700	4.228	4.396	20.650	20.681
March	4.084	4.720	4.000	4.421	18.911	21 266
April	4.356	5.115	4.272	4.946	20.589	22.993
May	4.952	5.420	4.784	5.281	23.399	24.462
June	4.485	5.745	4.293	5.563	22.563	24.685
July	4.410	5.729	4.260	5.447	23.399	24.869
August	4.382	5.824	4.217	5.537	23.489	24.580
September	4.600	6.110	4.392	5.868	23.148	24.131
October	4.690	.....	4.439	.....	23.679	.....
November	4.683	.....	4.356	.....	24.483	.....
December	4.700	.....	4.369	.....	25.322	.....
Year	4.545	.....	4.363	.....	22.752	.....

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1921	1922	1921	1922	1921	1922
January	31.470	31.480	36.000	32.100	190.464	163.065
February	28.534	29.835	32.142	30.767	166.250	149.850
March	27.296	28.426	28.806	29 171	156.024	143 152
April	28.990	29.810	30.404	30.605	163.905	149.840
May	31.431	30.149	32.500	30.971	177.411	150.163
June	28.514	30.707	29.423	31.497	167.506	152.512
July	26.755	31.025	27.655	31.733	164.530	156.149
August	25.662	32.134	26.301	32.380	155.318	160.006
September	26.280	32.075	26.680	32.395	156.750	160.065
October	27.278	.....	27.655	.....	156.380	.....
November	28.592	.....	28.935	.....	158.898	.....
December	32.106		32.486	.....	169.738	.....
Year	28.576	.....	29.916	.....	165.265	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1921	1922	1921	1922
January	5.413	4.691	25.262	26.321
February	4.928	4.485	24.850	24.213
March	4.737	4.658	25.077	25.467
April	4.747	4.906	25.530	26.576
May	4.848	5.110	26.923	27.304
June	4.421	5.346	26.750	27.893
July	4.239	5.694	26.262	29.042
August	4.186	6.212	25.068	31.170
September	4.235	6.548	25.256	31.750
October	4.605	.....	26.315	.....
November	4.667	.....	25.949	.....
December	4.835	.....	26.900	.....
Year	4.655	.....	25.845	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)	
	New York		New York		New York	
	1921	1922	1921	1922	1921	1922
January	5.258	4.463	48.440	49.960	73.400	97.260
February	5.250	4.416	49.545	48.295	70.227	89.545
March	5.282	4.319	46.796	50.204	72.463	87.500
April	5.137	4.980	45.423	52.280	73.404	87.500
May	5.250	5.467	47.000	54.885	73.740	85.529
June	5.087	5.145	46.846	55.115	74.942	87.212
July	4.735	5.091	44.950	55.000	70.440	90.180
August	4.597	5.315	45.028	57.593	73.222	98.370
September	4.564	6.580	42.660	67.640	75.960	117.280
October	5.085	.....	39.840	.....	81.800	.....
November	4.734	.....	39.804	.....	82.609	.....
December	4.500	.....	49.212	.....	78.192	.....
Year	4.957	.....	45.462	.....	75.033	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1921	1922	1921	1922	1921	1922
January	33.96	21.55	31.96	20.15	33.88	21.34
February	28.96	21.46	26.96	19.71	30.25	20.88
March	28.16	21.35	26.46	19.96	27.85	20.83
April	26.96	22.50	24.46	21.26	26.77	22.70
May	26.21	26.36	23.84	26.87	25.56	25.96
June	24.96	26.96	22.66	26.96	24.38	25.96
July	22.84	26.77	20.76	26.33	22.36	25.97
August	21.96	30.44	20.29	27.18	21.53	30.81
September	21.96	35.27	21.21	34.70	22.82	36.75
October	21.96	.....	20.96	.....	22.96	.....
November	21.96	.....	20.96	.....	22.74	.....
December	21.96	.....	20.65	.....	21.96	.....
Year	25.15	.....	23.43	.....	5.26	.....

In dollars per long ton.

Monthly Crude Copper Production

	1922			
	May	June	July	August
Alaska shipments	7,969,538	6,321,793	4,510,953	3,366,952
Anaconda	17,700,000	15,100,000	13,600,000	14,000,000
Calumet & Arizona	3,566,000	3,362,000	3,310,000	4,038,000
Calumet & Hecla	(c)	(c)	(c)	(c)
Other Lake Superior	(c)	(c)	(c)	(c)
Chino	1,670,684	3,840,511	(c)	(c)
East Butte	(c)	(c)	(c)	(c)
Inspiration	(c)	(c)	(c)	(c)
Magma	(a)	(a)	(a)	(a)
Miami	5,546,000	5,923,000	5,915,000	6,383,000
Nevada Cons.	5,103,277	4,286,740	(c)	(c)
New Cornelia	1,544,770	1,565,442	1,783,950	2,854,183
Old Dominion	2,690,000	2,870,000	2,787,000	2,718,000
Phelps Dodge	6,228,000	7,512,000	6,645,000	7,615,000
Ray	2,107,335	2,914,364	(c)	(c)
Shattuck Arizona	(a)	(a)	(a)	(a)
Southwest Metals Co.	(a)	(a)	570,000	575,000
United Verde	670,000	4,570,000	5,600,000	6,000,000
United Verde Extension	2,790,136	2,941,054	2,646,810	3,250,934
Utah Copper	9,082,371	9,484,055	(c)	.....
Others, estimated	18,750,000	14,800,000	9,600,000	10,500,000
Total United States	.....	.....	.....	.....
Imports: Ore and concentrates, matte	6,270,622	8,175,880	10,934,340	.....
Imports of black and blister, unrefined	9,700,997	14,596,714	25,656,776	.....
Imports of refined and old	11,361,330	28,321,991	7,230,319	.....
Grand total	.....	.....	.....	.....
Backus & Johnston	1,108,000	1,276,000	(c)	(c)
Boleo	1,499,120	1,377,500	1,171,958	1,364,025
Cananea	(a)	(a)	1,105,958	(c)
Cerro de Pasco	6,234,000	5,868,000	(c)	(c)
Chile	10,854,730	11,460,680	(c)	(c)
Cons. M. & S. of Canada	153,115	53.020	(a)	(a)
Falcon Mines	586,000	592,000	549,120	.....
Furukawa	2,820,880	2,725,989	.....	.....
Granby Cons.	2,294,025	2,263,339	2,601,007	2,924,760
Hampden Cloncurry	(c)	(a)	(a)	(c)
Katanga	8,370,792	8,859,690	8,972,145	8,553,195
Mount Morgan	(a)	1,416,000	920,000	(c)
Mount Lyell	784,000	978,000	900,000	(c)
Phelps Dodge Mexican	862,000	1,098,000	1,505,000	1,587,000
Sumitomo	2,751,843	.....	2,298,856	.....
Wallaroo & Moonta	( )	(a)	(a)	(a)

Comparative Annual Copper Production

	1919	1920	1921	1922
January	135,733,511	121,903,744	90,596,597	32,010,292
February	111,649,512	117,540,000	86,682,941	45,957,53u
March	102,040,460	120,309,316	91 046,345	55,705,76u
April	98,808,998	116,078,871	46,946,523	(c)
May	92,652 975	114,964,207	25,310,511	(c)
June	95,856,570	116,107,856	24,623,693	(c)
July	100,369,247	109,729,610	22,033,739	(c)
August	107,994,040	112,460,254	23,248,398	( )
September	108,703,075	104,919,562	23,855,316	(c)
October	115,143,143	105,231,571	23,231,572	.....
November	117,289,735	106,700,178	28,341,442	.....
December	102,997,633	95,709,009	29,629,137	.....

(a) No copper produced during this month. (c) Not available.

COMPANY REPORTS

Burma Corporation, Ltd.

Silver-Lead; Burma

A report of operations of Burma Corporation, Ltd., for the quarter ended June 30, 1922, shows that 43,501 tons of ore was extracted, having an average assay value of 27.6 oz. of silver, 29.8 per cent of lead and 18.5 per cent of zinc. The tonnage extracted is equivalent to an output of 44 tons per man-shift employed underground. It is stated that 45,179.2 tons of ore was milled, averaging 25.6 oz. of silver, 28.2 per cent of lead, and 17 8 per cent zinc. This included 856 tons of stock material from the mine ore dumps, averaging 22.1 oz. of silver, 23.9 per cent of lead and 21.3 per cent of zinc; 28.964.5 tons of lead concentrates was produced, averaging 36.4 oz. of silver, 40.1 per cent of lead, and 21.6 per cent of zinc. A total of 32,383 tons of lead-bearing material was smelted, for a production of 10,368 tons of hard lead, assaying 104.3 oz. of silver per ton.

The refinery produced 9,450 tons of refined lead and 996,842 oz. of refined silver.

ESTIMATED REVENUE AND EXPENDITURE

Estimated gross revenue	Rs.62,18,200	£414,546	13s.	4d.
Estimated operating expenditure	37,64,600	250,973	6	8
Estimated surplus over working expenditure	Rs.24,53,600	£163,573	6	8
Debenture interest	Rs.3,06,700	£20,446	13	4
Estimated income tax	2,40,000	16,000	0	0
Estimated depreciation on machinery and plant	4,20,000	28,000	0	0
Capital expenditure	7,97,600	53,173	6	8

On the No. 7 level. the Chinaman orebody was intersected in West Crosscut 747 ft. south of Winze 740, with entirely satisfactory results. South Drive 47 ft. east was started off this crosscut to permit of orebody being intersected by other crosscuts at suitable intervals. Winze 1,135 ft. south has reached horizon of this level and pumps have been installed.

The diversions and protective works carried out during the dry season have resulted in full railway service being maintained without interruption during the early rains.

Satisfactory progress continues to be made with improvements to plant.

Shifts worked at mine show reduction consequent upon usual migration of seasonal labor.

The recruiting expedition returned from China with over 400 men from three separate localities. Observations so far indicate that those from one district will make efficient miners, and an agent will be dispatched to obtain further recruits from the same locality to arrive at the mine in December next. The increased revenue is due to improved metal prices. The increased expenditure is due to adjustment of realization charges on zinc ore and lead.

Buena Tierra Mining Co., Ltd.

Silver-Lead; Mexico

A report and an audited statement of accounts of the Buena Tierra Mining Co. for the year ended Dec. 31, 1921, shows an excess of expenditure over receipts for the year of £17,853 0s. 6d., which added to the debit balance brought forward, viz. £39,346 14s. 2d., makes a total deficiency to date of £57,199 14s. 8d.

From Jan. 1 to June 30, 1921, the company continued its operations, raising 760 tons of ore and shipping in all to the smelter 1,236 tons. After deducting cost of freight and treatment, these shipments realized $10,332.69 (U. S. currency), an average of $8.95 per ton. Of the excess expenditure shown above—viz. £17,853 0s. 6d.—$55,395.09 (or £14,388 6s. 9d.) was spent on exploration and development work up to the end of June, when, as anticipated in the last report, the mine was closed down and the engagement of Mr. Brinker as general manager terminated. Subsequently, a lease of the property was granted to W. S. Dwelly (formerly the mine superintendent) from Aug. 1, and as a result of his operations to the end of December, a royalty of £428 0s. 5d. shown in the profit-and-loss account accrued to the company. This lease was later extended and ran until June 30, 1922, during which time the royalty accruing to the company has practically covered the cost of looking after and policing the company's property.

Toward the end of the year J. C. Pickering was appointed consulting engineer of the company in place of R. M. Raymond, whose other professional engagements made increasing calls upon his time. Mr. Pickering, with the experience gained by the work done under the lease to guide him, has advised that the company should take over the operation of the property as from July 1, 1922, and arrangements have now been made to that effect, with W. S. Dwelly in charge of the local operations. It is hoped that, with present slightly improved conditions, profits can be made from the shipments of carefully selected ore, which, with the remaining cash resources of the company, will make possible further exploration and development of the property on the most economical lines.

Tonopah Belmont Development Co.

Silver; Nevada

A condensed statement of the operations of the Tonopah Belmont Development Co. for the quarter ended June 30, 1922, follows:

Received and receivable for ore	$504,082.97
Mining, milling and administration expenses	346,811.25
Net earnings for three months	$157,271.72
Miscellaneous income	5,754.76
Total net income for three months ended June 30, 1922	$163,026.48

AVAILABLE RESOURCES, AUG. 31, 1922

Due from smelter	$234,467.72
Due from others	54,902.45
Cash in banks	245,741.51
U. S. government certificate of indebtedness	100,000.00
Liberty bonds	50,220.14
	$685,331.82

The net earnings for the quarter ended June 30, 1922, of the Belmont Surf Inlet Mines, Ltd., of which this company owns 80 per cent, were $7,829.78.

East Butte Copper Mining Co.

Copper; Montana

The East Butte Copper Mining Co. today has in cash, copper, and Liberty bonds approximately $1,500,000. It does not owe a dollar, having paid off early this year a small loan it had against Liberty bonds. In the first six months of 1922 results showed on the profit side of the ledger, and though the company is today making expenses, it is charging into production costs all new construction, shaft sinking expenses, and extraordinary repairs.

The company is increasing the capacity of its milling plant by 250 tons. This will give the completed unit capacity for milling 1,000 tons of ore daily. The cost will not be large, and will be paid from East Butte's treasury.

Although the company is following the practice of many mining companies in not announcing production, its copper production is said to be running around 1,650,000 lb. monthly. This includes the product of Davis-Daly's ores, which are shipped to the East Butte smelter and treated on a custom basis.

MINING STOCKS

Week Ended Sept. 30, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	62	62	62	Aug. '22, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	3⅛	2⅞	2⅞		
Allouez	Boston	23	23	23	Mar. '19	1.00
Anaconda	New York	54	50⅝	51	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅛	2	2		
Ariz. Com'l	Boston	8⅛	7⅛	7⅛	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*10	*8	*10		
Bingham Mines	Boston	†18	†17½	17½	Sept. '19, Q	0.25
Calumet & Arizona	Boston	61	59	59	Sept. '22, Q	0.50
Calumet & Hecla	Boston	285	280	280	Aug. '22, Q	5.00
Canada Copper	N. Y. Curb	*2	*2	*2		
Centennial	Boston	†9	†9	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	39½	37½	37½	Mar. '21, Q	0.50
Chile Copper	New York	26	24⅜	25⅛		
Chino	New York	30⅜	28½	28	Sept. '20, Q	0.37½
Con. Copper Mines	N. Y. Curb	....	....	*25		
Copper Range	Boston	41	39½	40½	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1⅛	1⅛	1 1/16		
Davis-Daly	Boston	4½	4½	4½	Mar. '20, Q	0.25
East Butte	Boston	10⅛	9⅞	10	Dec. '19, A	0.50
First National	Boston Curb	*55	*50	*54	Feb. '19, SA	0.15
Franklin	Boston	1⅛	1⅛	1⅛		
Gadsden Copper	Boston Curb	*85	*75	*85		
Granby Consol.	New York	32	29½	30½	May '19, Q	1.25
Greene-Cananea	New York	30⅛	30¼	30¼	Nov. '20, Q	0.50
Hancock	Boston	†2⅝	†2	2		
Howe Sound	N. Y. Curb	3⅛	3	3⅛	Jan. '21, Q	0.05
Inspiration Consol.	New York	40⅛	38⅛	38⅞	Oct. '20, Q	1.00
Iron Cap	Boston Curb	8⅛	8	8⅛	Sep. '20, K	0.25
Isle Royale	Boston	22⅝	21⅛	21⅛	Aug. 22,	0.50
Kennecott	New York	35⅛	33	33⅜	Dec. '20, Q	0.50
Keweenaw	Boston	2⅛	1⅞	1⅞		
Lake Copper	Boston	3⅛	3⅛	3⅛		
La Salle	Boston	†1⅛	†1⅛	1⅛		
Magma Copper	N. Y. Curb	....	....	34	Jan. '19, Q	0.50
Majestic	Boston Curb	*6	*6	*6		
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Mass. Consolidated	Boston	3	2⅞	3	Nov. '17, Q	1.00
Miami Copper	New York	28⅜	27⅜	27⅜	Aug. '22 Q	0.50
Michigan	Boston	2⅜	2⅜	2⅜		
Mohawk	Boston	61	59	60½	July '22, Q	1.00
Mother Lode Con.	N. Y. Curb	....	....	11	June '22, I	0.50
Nevada Consol.	New York	16⅛	15	15	Sept. '20, Q	0.25
New Cornelia	Boston	18	17⅞	18	Aug. '22, K	0.25
North Butte	Boston	11⅛	10⅝	10⅝	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*25	*18	*22		
Old Dominion	Boston	23	23	23	Dec. '18, Q	1.00
Osceola	Boston	35⅜	33	33	Aug. '22, Q	1.00
Phelps Dodge	Open Mar.	†175	†165	...	July. '22, Q	1.00
Quincy	Boston	40	38	38	Mar. '20, Q	1.00
Ray Consolidated	New York	15⅜	13⅞	14⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅜	1⅜	1⅜		
St. Mary's Min. Ld.	Boston	44	43	43	Apr. '22, K	2.00
Seneca Copper	Boston	11⅛	11⅛	11⅛		
Shannon	Boston	*80	*70	*75	Nov. '17, Q	0.25
Shattuck Arizona	New York	9⅛	8⅛	9⅛	Jan. '20, Q	0.25
South Lake	Boston	*35	*35	*35		
Superior & Boston	Boston	1⅜	1	1⅛		
Tenn. C. & C. cfs	New York	10	9⅛	9⅛	May '18, I	1.00
Tuolumne	Boston	*55	*45	*55	May '13,	0.10
United Verde Ex.	Boston Curb	31	29⅛	29⅞	Aug. '22, Q	0.25
Utah Consol.	Boston	2⅛	2⅛	2⅛	Sept. '18,	0.25
Utah Copper	New York	68	64⅛	64⅜	Sept. '22, Q	0.50
Utah Metal & T.	Boston	1⅜	1⅜	1⅜	Dec. '17,	0.30
Victoria	Boston	1⅛	1⅛	1⅛		
Winona	Boston	1⅛	1⅛	1⅛		
Wolverine	Boston	10⅛	10⅛	10⅛		
NICKEL-COPPER						
Internat. Nickel	New York	17⅞	16⅛	16⅜	Mar. '19,	0.50
Internat. Nickel, pfd	New York	84⅛	82⅛	82⅛	Aug. '22, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	5⅜	5⅜	5⅜		
National Lead	New York	106	102⅞	103	Sept. '22, Q	1.50
National Lead, pfd	New York	116	116	116	Sept. '22 Q	1.75
St. Joseph Lead	New York	20⅛	18	18⅛	Sept. '22 Q	0.25
QUICKSILVER						
New Idria	Boston	†*40	....	....		
ZINC						
Am. Z. L. & S.	New York	19⅞	17⅜	18⅜	May '20,	1.00
Am. Z. L. & S. pfd.	New York	55	50⅛	51⅛	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅜	6⅜	7	June '18,	0.50
Butte & Superior	New York	32⅜	30⅛	31⅛	Sept. '20,	1.25
Callahan Zn-Ld.	New York	9⅜	9⅛	9⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	155¼	154⅛	154⅛	Aug. '22, Q	2.00
Yellow Pine	Los Angeles	...	...	*50	Sept. '20, Q	0.03

Stock	Exch.	High	Low	Last		Last Div
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Atlas	Toronto	*35½	*24½	*25½		
Carson Hill	Boston	9	8⅛	8⅛		
Cresson Consol. G.	N. Y. Curb	2⅞	2⅞	2 13/16	July '22, Q,X	$0.10
Dome Mines	New York	39	35	35½	July '22, Q	.50
Florence Goldfield	N. Y. Curb	*15	*15	*15		
Golden Cycle	Colo. Springs	*92½	*92½	*92½	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	*8	*6	*7	Dec. '19,	0.05
Hollinger Consol.	Toronto	13.45	11.80	11.90	Sept. '22,	0.05
Homestake Mining	New York	72	71½	72	Sept. '22, M	0.25
Keora	Toronto	*12½	*10½	*11½		
Kirkland Lake	Toronto	....	....	*47		
Lake Shore	Toronto	2.87	2.57	2.8[illegible]	Aug. '22, Q	0.02
McIntyre-Porcupine	Toronto	19.25	...00	17.60	Sept. '22, K	0.25
Porcupine Crown	Toronto	*24½	*21½	*22	July '17,	0.03
Portland	Colo. Springs	†*40	† 37½	*40	Oct. '20, Q	0.01
Schumacher	Toronto	*58	*55½	*55½		
Silver Pick	N. Y. Curb	*9	*9	*9		
Teck Hughes	Toronto	*80	*78	*78½		
Tom Reed	Los Angeles	*88	*80	*84	Dec. '19,	0.02
United Eastern	N. Y. Curb	1¼	1⅛	1⅛	July '22, Q	0.15
Vindicator Consol.	Colo. Springs	†*5	†*3	*4	Jan. '20, Q	0.0[illegible]
Vipond Con	Toronto	*70	*61	*63		
White Caps Mining	N. Y. Curb	*14	*12	*14		
Wright-Hargreaves	Toronto	3.25	2.95	3.10	July '22,	0.02½
Yukon Gold	N. Y. Curb	*90	*80	*90	June '18,	0.02½
SILVER						
Batopilas Mining	New York	⅜	⅛	⅜	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*35	*29½	*30	May '20, K	0.03
Coniagas	Toronto	1.45	1.45	1.45	May '21, Q	0 12½
Crown Reserve	Toronto	*25	*23	*25	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3⅛	3⅛	3⅛	July '22, Q	0.12½
La Rose	Toronto	*29½	*25	*26	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*28	*25	*26	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1	1	1	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6⅛	5⅜	5⅜	July '22, Q, X	0.30
Ontario Silver	New York	8	7½	7½	Jan. '19, Q	0.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	0.10
Temiskaming	Toronto	*40	*35	*38	Jan. '20, K	0.04
Trethewey	Toronto	*5½	*4½	*5	Jan. '19,	0.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*11	*9	*9		
Cash Boy	N. Y. Curb	*10	*9	*9		
C ns. Virginia	San Francisco	*19½	*18½	*18		
Dolores Esperanza	N. Y. Curb	2⅛	1 15/16	1 15/16	July '22,	2.50
El Salvador	N. Y. Curb	*11	*7	*9		
Jim Butler	N. Y. Curb	....	....	*7	Aug. '18, SA	0.07
Jumbo Extension	N. Y. Curb	*7	*6	*6	June '16,	0.05
MacNamara M.& M.	N. Y. Curb	*8	*7	*7	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1⅛	1 1/16	1 1/16	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*81	*76	*78		
Tonopah Extension	N. Y. Curb	2 3/16	2⅛	2 3/16	July '22, Q	0.05
Tonopah Mining	N. Y. Curb	2⅛	2 1/16	2⅛	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1⅛	1 1/16	1⅛	Sept. '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*8	*7	*8	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	†*63	†*55	*60	Dec. '20,	0.15
Chief Consol.	Boston Curb	5⅛	5⅛	5⅛	Aug. '22, Q	0.10
Columbus Rexall	Salt Lake	*19½	*19	*19	Aug. '22,	0.03
Consol. M. & S.	Montreal	26⅛	25½	25½	Oct. '20, Q	0.62½
Daly Mining	Salt Lake	†3.00	†1.50	...	July '20, Q	0.10
Eagle & Blue Bell	Boston Curb	†*5	†*3	*3½	Apr. '21, K	0.05
Electric Point	Spokane	*3	*2½	*2½	May '20, SA	0.03
Federal M. & S.	New York	†16	†12½	15	Jan '09,	1.50
Federal M. & S. pfd.	New York	62	58	58½	Sept. '22, Q	1.25
Florence Silver	Spokane	*39	*36½	*39	Apr. '19,	0.01½
Grand Central	Salt Lake	†*65	†*60	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	7⅜	7⅛	7⅛	Sept. '22, Q	0.15
Iron Blossom Con.	N. Y. Curb	*27	*27	*27	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	4	4	4	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*15	*12	*12	June '21, I	0.02
Prince Consol.	Salt Lake	*10½	*9½	*9½	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*4⅛	*3½	*4⅛	Feb. '19,	0.01
Rex Consol.	N. Y. Curb	*8	*7	*7		
Standard Silver-Le	N. Y. Curb	....	....	*19	Oct. '17,	0.05
Stewart Mines	N. Y. Curb	*8	*6	*7	Dec. '15,	0.05
Tamarack-Custer	Spokane	3.25	3.15	3.25	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2.72½	2.17½	2.70	Sept. '22, K	0.05
Utah Apex	Boston	2⅛	2⅛	2⅛	Nov. '20, K	0.25
Wilbert Mining	N. Y. Curb	*5	*4	*5	Nov. '17,	0.01
VANADIUM						
Vanadium Corp.	New York	49½	43⅛	44	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp	Montreal	68⅛	66	68	July '22, Q	1.50
Asbestos Corp. pfd.	Montreal	....	....	85	July '22, Q	1.75
SULPHUR						
Freeport Texas	New York	23⅛	21⅛	21⅛	Nov. '19, Q	1.00
Texas Gulf	New York	56⅛	54⅛	55	Sept. '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Metal	.....	48	45⅜	46	Sept. '22,	0.75
Amer. Metal pfd	.....	113	109⅜	109⅜	Sept. '22, Q	1.75
Amer. Sm. & Ref.	New York	62⅛	59	59⅛	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	103	100	100	Sept. '22 Q	1.75
Am. Sm. Sec. pfd. A	New York	97	97	97	July '22, Q	1.50
U. S. Sm. R. & M.	New York	43	40¼	40¼	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	†48⅛	†45	48⅛	July '22, Q	.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra.

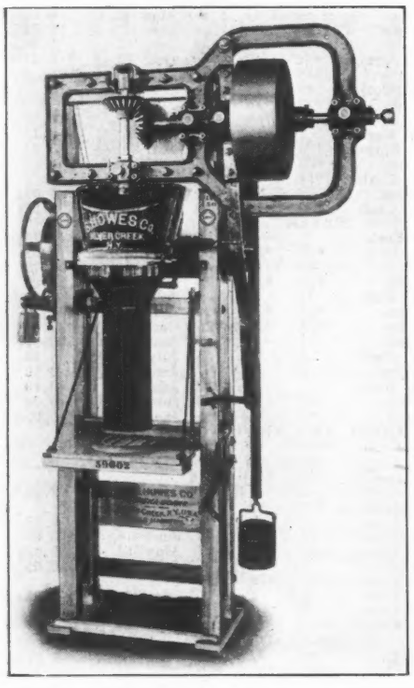
Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange, Los Angeles, Chamber of Mines and Oil; Colorado Springs, The Financial Press, N. Y.

NEW MACHINERY AND INVENTIONS

A New Automatic Friction-Driven Packer

A friction-driven packer that is automatic is adapted to a wide range of work, for it will handle easily and rapidly any material, pulverized, granular, or fibrous, that can be compressed into a container.

A heavy maple frame is assembled to form a solid unyielding unit. A one-piece webbed casting of great strength carries all four bearings, having extra-long journals cast integral with the iron front, thus insuring rigidity and alignment of the two



Automatic friction-driven packer

shafts, and, besides, preventing undue wear of the bevel gears. The friction clutch is of the simple cone type, faced with thermoid and bronze bushed. This combination makes a drive that releases instantly and engages gently. A full complement of compression grease cups provides for lubrication of shaft bearings and friction clutch, and the special auger equipment packs evenly and quickly without undue friction. The carriage which supports the barrel or other package is strong, well-braced, and suspended by heavy steel chains passing over sleeves of large diameter, and to eliminate unnecessary friction is provided with rollers which run on steel guides. The device used for raising the platform consists of a non-stretchable belt rolling over a double-flanged pulley and connected with a heavy weight.

A uniform weight in each barrel or sack is made possible by an adjustment attached to the brake lever. By slightly moving a weight, more or less material, as desired, can be compressed into the package. Practically all the attendant has to do is to put on the empty sack or barrel and take off the filled package. The empty barrel is placed on the platform, and the latter ascends to its proper position by slightly raising a lever. The friction clutch is then thrown into contact by pushing a second lever; packing now begins. The platform gradually recedes with the accumulating weight in the package, and as soon as the latter is filled an adjustable trip disengages the clutch, shuts off the power, and the platform descends to the floor. The filled package is then ready for removal.

The height of the packer is 9 ft. 8½ in.; width, 5 ft. 6 in.; depth, 3 ft. 3 in.; height center drive pulley, 8 ft. 2 in.; speed, 175 r.p.m.; bevel gear on upright, 35 cogs; pinion on countershaft, 26 cogs; size of hopper, inside, 14 by 24 in.; size of drive pulley, 24 by 7½ in.; shipping weight, 1,950 lb. The new friction-driven automatic packer is the product of the S. Howes Co., Inc., Silver Creek, N. Y.

INDUSTRIAL NOTES

Crane and Ordway Co., of Duluth, Minn., distributors of and wholesale dealers in valves, fittings, and pipes, have changed the name of the firm to the Crane Company of Minnesota. There has been no change in management.

The White Co. and the White Motor Co. announce the removal of their general offices from 6,611 Euclid Ave., Cleveland, Ohio, to the Administration Building, at the factory, St. Clair Ave. and East 79th St. The Cleveland branch of the White Co. retains its present location, 407 Rockwell Ave.

Johns-Manville, Inc., has been appointed joint selling agents of Asbestos Protected Metal by the H. H. Robertson Co. In the future all Asbestos Protected Metal roofing, siding accessories, and ventilators will be manufactured and shipped from the plant of H. H. Robertson Co. at Ambridge, near Pittsburgh, Pa. This metal is largely used by industrial establishments for all conditions where an unprotected metal or other equally perishable roofing material would quickly disintegrate.

E. J. Atchison, of the Southwestern Engineering Co., Los Angeles, Calif., has just returned from Salt Lake City and Park City, Utah. L. C. Penhoel, who has been in Mexico for the last two years, representing the company, is returning to Los Angeles this month. Jesse J. McDonald has gone to Mexico City, where he will represent the Southwestern Engineering Co. in Mexico. His address is 16 de Septiembre 5, Mexico City. Edward Thornton has taken over the interest of Max Kraut in the company.

CONSTRUCTION NEWS

Construction of Railroad to Sulphur Plant Is Progressing

The railway extension of the Freeport Sulphur Co. from the Houston & Brazos Valley R.R., near Clute, Tex., to Hoskins Mound, where the new sulphur plant is to be installed, is now completed to a point beyond Stratton Ridge.

New Steel Shafthouse at Trimountain Mine

The Copper Range Mining Co., in the Lake Superior copper district, has awarded a contract for the erection of a steel shafthouse at No. 2 shaft of its Trimountain mine, to the Wisconsin Bridge & Iron Co.

Three-Compartment Shaft at Crestline, Kan.

Work on a three-compartment shaft, 4½ x 13 ft., is to be started at once by the Interstate Zinc-Lead Corporation, of Picher, Okla., on its lease in the Crestline, Kan., field, near that of the Kanok Metal Co.'s McBee mine. A. M. Gaines is manager.

Mill for Golden Age Junior

The Golden Age Junior Mining Co., of Boise, Idaho, is planning to erect a mill that will have a grinding unit capable of handling fifty tons in eight hours. The rest of the mill will handle this tonnage in twenty-four hours, but eventually will be enlarged to handle 150 tons in twenty-four hours. A storehouse, two bunk houses, club house and a cookhouse are also being built.

Crushing Unit for Pioche Mines Co.

The Pioche Mines Co. at Pioche, Nev., is planning the immediate erection of a coarse crushing unit which will be built independently of the main mill building and at the terminus of the tramway from the mines. These are situated at two localities, both of which are about a mile from the mill. A strike of high-grade silver-lead ore was recently made at the Wideawake mine owned by the company.

Gold Chain Company Hopes To Complete 100-Ton Mill by Jan. 1

The Gold Chain company, at Kingman, Ariz., will have a 100-ton mill in operation by the end of the year, to handle 100,000 tons of ore above the tunnel level, said to sample above $5. The mill is to have a No. 2 Austin gyratory crusher and a Marcy ball mill, grinding to 200 mesh. The pulp will be handled in Vandercook classifiers, amalgamator, thickener, and clarifier. Extraction of 90 per cent is expected by H. J. Kinkead, who will have charge of the installation.